

# creative computing

January 1981  
vol 7, no 1  
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*the #1 magazine of computer applications and software*

## Graphics and Animation

Printing Without Quotes  
Apple-Sketch  
Apple Lo-Res Shape Tables  
Apple Hi-Res Text  
Drawing With a Daisy Wheel  
Sorcerer Hi- and Lo-Res Graphics  
Crowd Stopper Animation  
Hexagons & Ellipses  
Permutations  
Spirograph

### Evaluations:

- TRS-80 Color Computer
- Apple Graphics Tablet
- Atari Music Composer
- Casheab Music Synthesizer
- New PETs

### Intelligent Videodiscs

### Dithering: A New Graphics Technique

### Columns:

- Apple • PET
- TRS-80 • Atari
- Software Legal Forum
- Effective Writing





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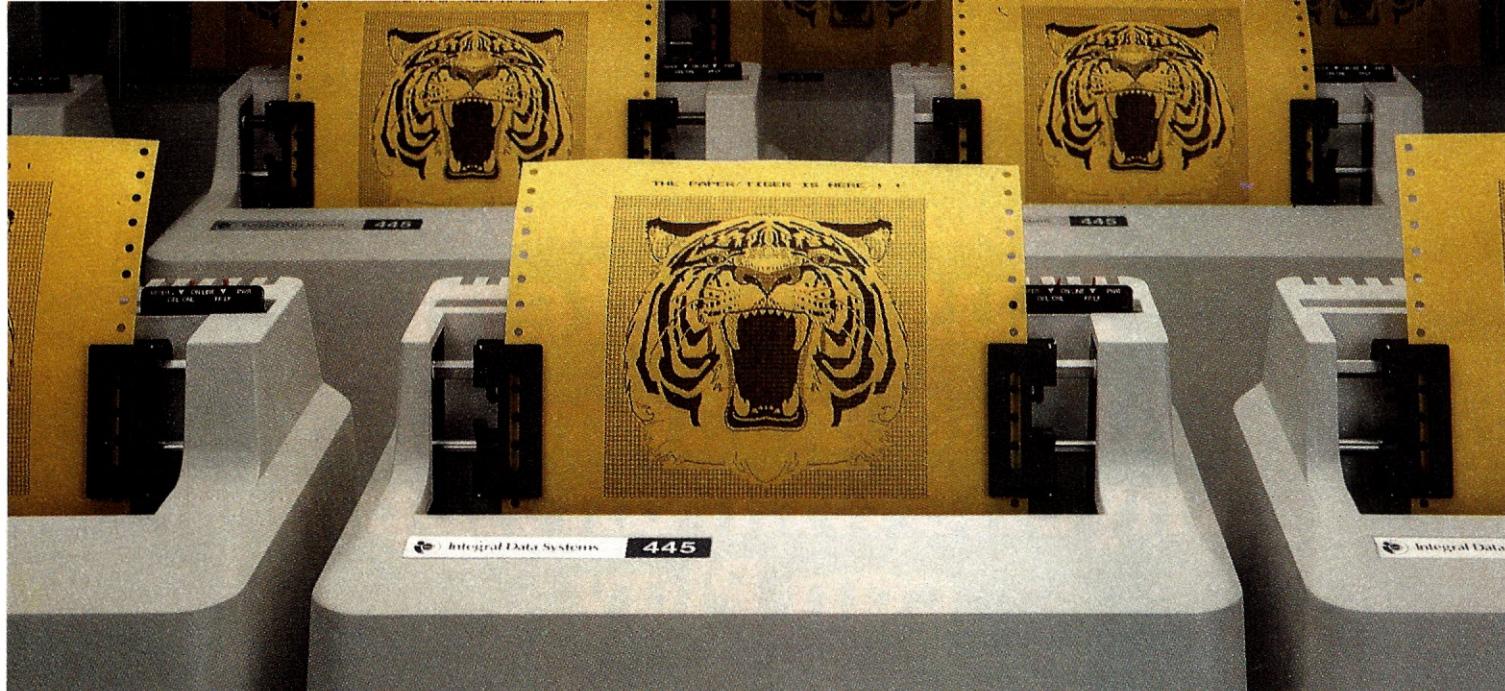
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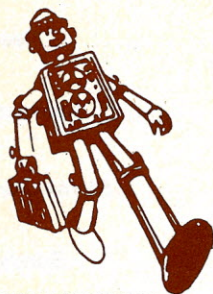
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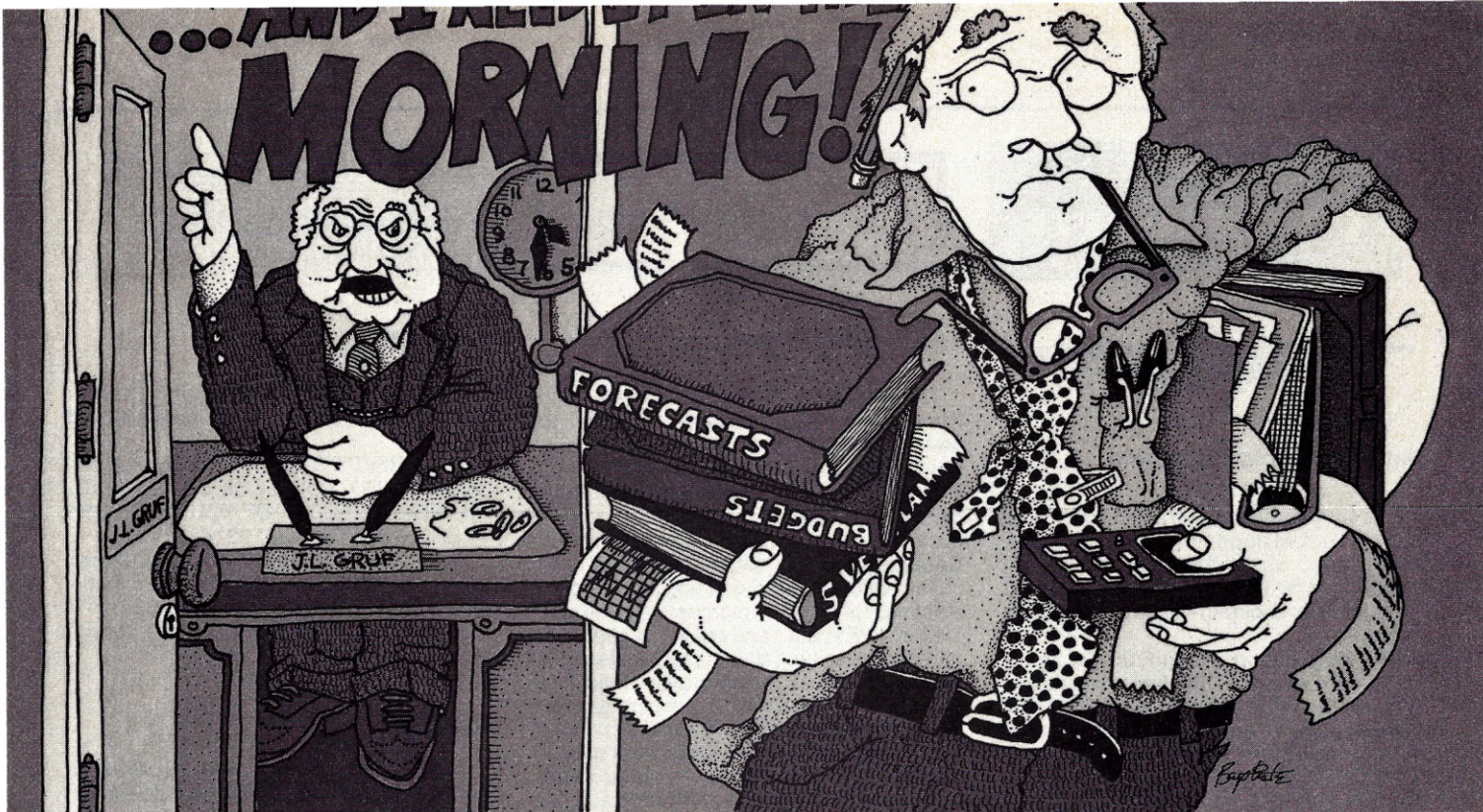
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## National Computer Camp

This summer youngsters can again sign up for an overnight camp in Moodus, Connecticut, where the main activity will be computers. The camp will be directed by Dr. Michael Zabinski, Professor at Fairfield University.

The 1981 National Computer Camp will feature two one week sessions: 1st session July 19-24; 2nd session July 26-31. The campers, ages 10-17, will enjoy small group instruction and mini and personal computers for ample "hands-on". Dr. Zabinski will be assisted by high school teachers.

The camp is for kids of all levels of experience including no experience whatsoever. In addition to computers, the campers will enjoy the superb recreational facilities of the Grand View Lodge including swimming and tennis.

For further information, contact Michael Zabinski, PH.D., at (203) 795-9069, or write to: Computer Camp, Grand View Lodge, Box 22, Moodus, CT 06469.

## TABS-Math Project

The College of Education of The Ohio State University has begun a project to develop and disseminate exemplary curricular materials in which high technology is used to teach basic mathematical skills including problem solving, estimation, computer literacy, etc. Funded by the U.S. Department of Education, the project will collect and evaluate existing educational software for small computers (e.g., Apple, TRS-80, PET, etc.) and select high quality units for inclusion. Other curricular elements will be developed by the project under the direction of Suzanne Damarin, Marlin Languis, and Richard Shumway. The curricula will be field tested and disseminated nationally. Individuals or groups who have developed programs related to mathematics at the upper elementary school level are invited to submit them for possible inclusion for national dissemination. To have materials considered, send a cassette tape of floppy disk together with a printout, machine documentation and any related information to: Dr. Suzanne K. Damarin, TABS Projects, Arps Hall 202-A, 1945 N. High St., Columbus, Ohio 43210. For further information write or call Dr. Damarin at (614) 422-1257.

## Corrections

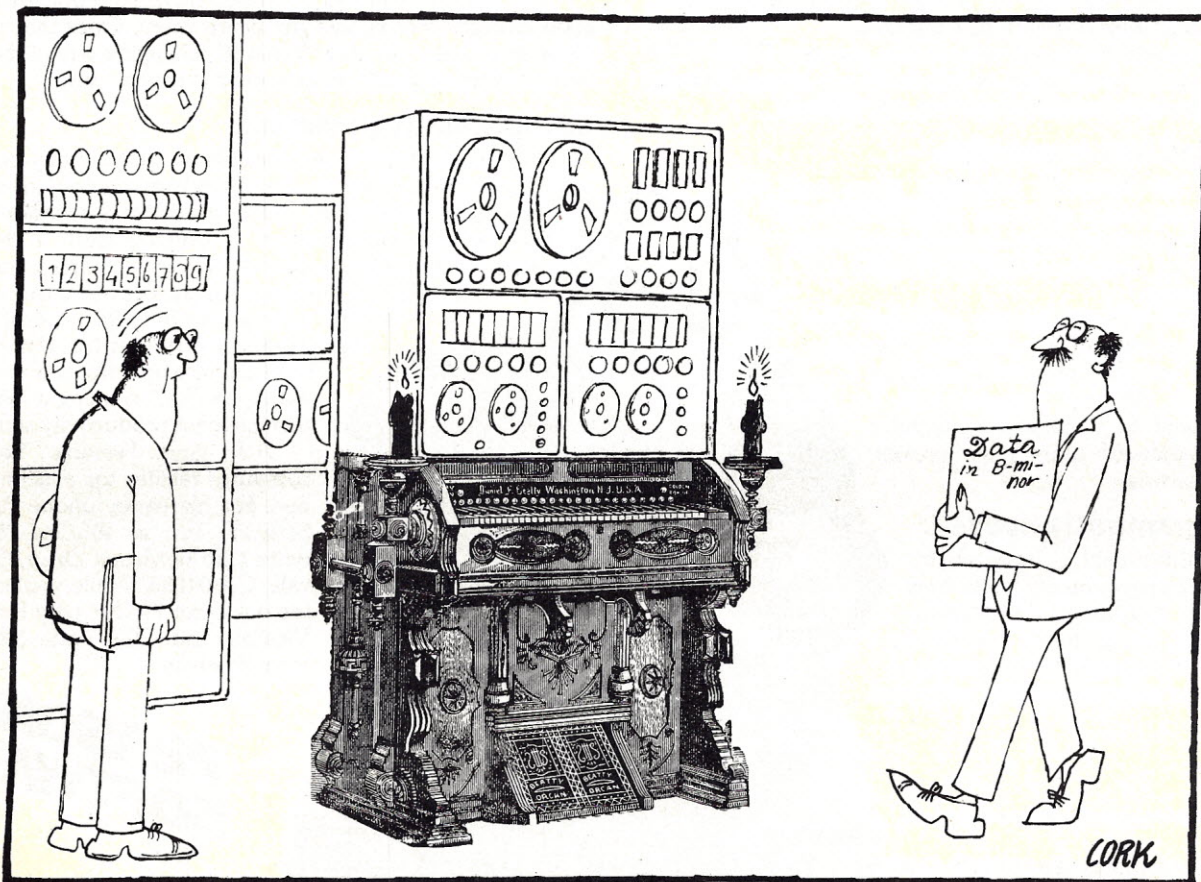
In "The Presidential Campaign" (October '80) on Page 120, Line 21416, the line should read:

21416 PRINT"YOU HAVE BEEN FOUND GUILTY AND YOU LOSE"; INT(100/(G-F));PRINT"PERCENT OF YOUR SUPPORT IN EACH STATE.";GOTO21420

The MicroNET number in the October '80 Apple Cart (Page 167) was listed incorrectly. It should be: (614) 457-8600. The per hour charge for the service is \$5, not \$4.

## TSUNAMI

*The Sorcerer Users' Newsletter Around Michigan* is a free bi-monthly newsletter for Exidy Sorcerer owners which concentrates on advanced applications in a variety of languages. Past issues have included a 7 generation / second Life, a Paper Tiger screen printer program, etc. SASE's and articles are requested but not required. Write: Joseph R. Power, 124 Cedar St #5, E. Lansing, MI 48823, (517) 337-1049.





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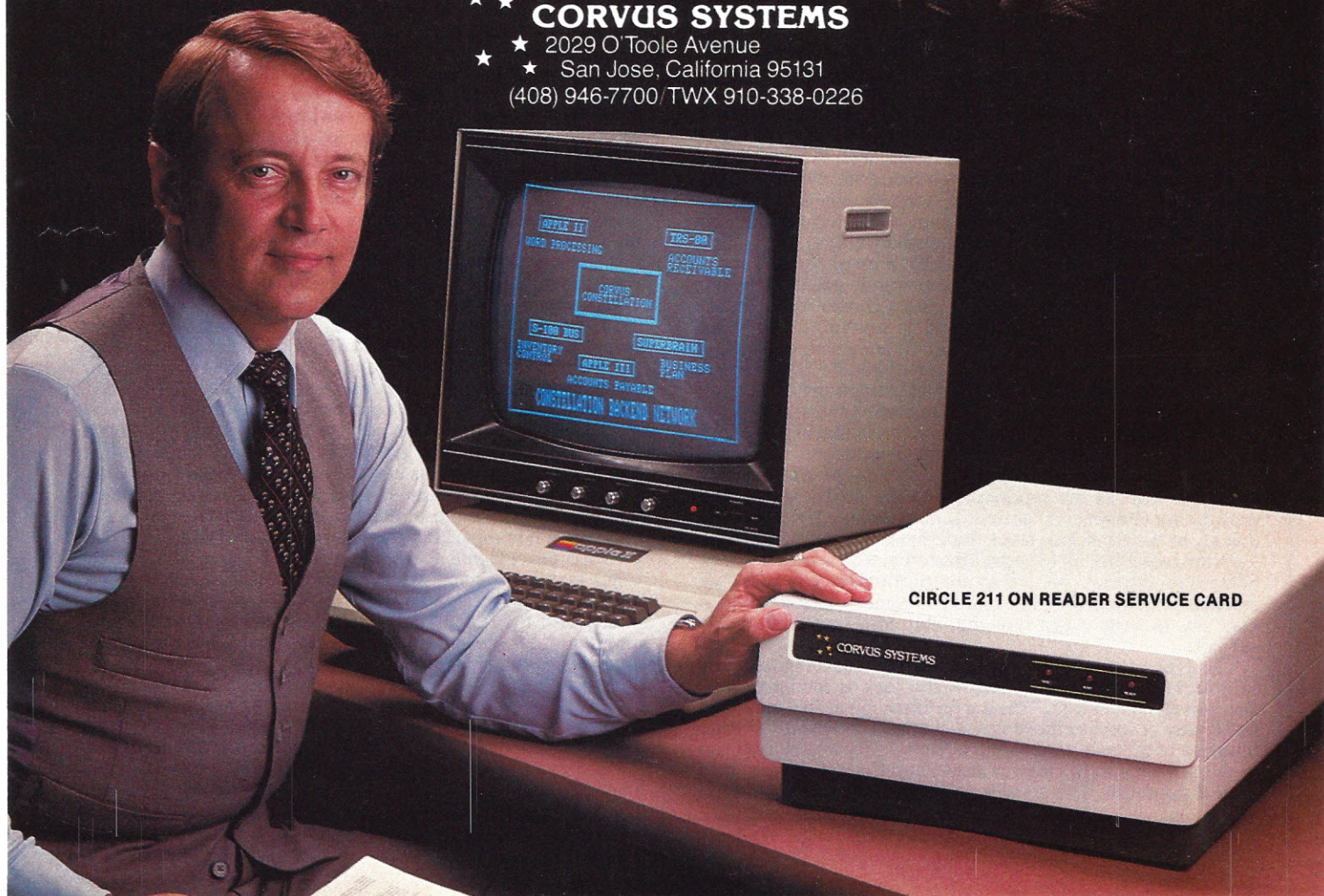
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# Input/ Output

## Re Creation

Dear Editor:

Raudsepp's "New Look at the Creative Process" (August '80) was most stimulating and rich in quotable references. Aaron Copeland's description of the moment of inspiration as a hallucination in split consciousness is similar to a dream state. A person can train oneself to retain a conscious detachment, an observer role, during dreams. If the dream is not too deep, the dream can be directed. For example, the conscious state can try to read some written matter in a dream moving a document in closer for examination. The observed text in this dreamer's experience turns out to be nonsense words. This is quite similar to Copeland's description of events during a creative mood.

Does Princeton Creative Research recognize different types of creativity? Generally, Raudsepp's article seems to address artistic creativity rather than problem solving creativity. The free form, even randomness, of creativity from a dreamlike state may suit the artist, but a scientist or engineer is likely to be creative from a more structured and orderly state. A problem is contemplated, puzzled over; it is turned over in the mind, viewed from different aspects and in abstract. The mind characterizes the problem by asking: "What is the problem? Is it well defined? What are the boundary conditions? What is known as opposed to what is only a presumption?" Then one can modify each assumption or set of assumptions, seeing if a solution presents itself, if the problem has similarities to other problems, or if it has analogs in one's experience.

This process is most creative, especially at the abstract level, but it lacks the randomness of the dream state. Still, answers are elusive and fleeting, hard to recover if not grasped quickly at the conscious level. Sometimes the ideas that come forth are most difficult to verbalize or otherwise make concrete. Sometimes the ideas are lost or are too abstract, in which case associative searches of the mind are appropriate wherein it may pay to write down thoughts that come to mind on the subject.

This type of creativity is very much like searching for a key to a lock, but the description of the lock is incomplete or deceptively inaccurate. This is a problem in pattern matching and it may be akin to those states of mind labeled by the word intuition of *déjà-vu*. In the end, however, since a solution to a problem is sought, the answer must stand the test of logic and a critical appraisal. The trick is to bring on this final phase of



evaluation late in the process, as Raudsepp has correctly observed.

Raudsepp seems contradictory in saying first that "Critical judgement must have recourse to past experience.... Being a past-oriented way of thinking, it is essentially opposed to the novel, the untried and the original." Later, he states, "During the heat of creative forming, the creative individual has to abandon himself entirely to his experience..." The experience of the past brings fruition to intuition. It supplies the creative process as well as the abstract template for problems and their solutions. Too much experience can block the creative process, however, if one fails to work against the natural reluctance to replot old ground.

Having correctly identified early application of the critical attitude as defeating to creativity, Raudsepp then attacks critical judgement itself and not its premature application as the issue. In the problem solving situation, critical judgement is essential. When the time is right, creative engineers will themselves apply this critical process and they will seek it from others whom they know can be constructive.

To deprecate the critical attitude is to misunderstand the creative process in engineering and science. This misunderstanding is compounded by Dr. Goshen's stereotyping of engineers, which is as accurate and as informative as any stereotyping. The cerebral cortex is as developed in engineers as it is in psychologists; there is as much variety in personality among engineers as there is in any other profession or trade. Dr. Goshen's stereotypes are certainly not the "highs," and if his comments are substantiated by his observations, then he needs to be guided to a more representative group of subjects.

One last comment: there surely are many techniques in the creative process and there may be more forms of creativity other than artistic and problem solving. Brainstorming is one such technique and perhaps Madison Avenue creativity is an example of the second type. Brainstorming has its advocates and it might fit the advertising business, but it has no place in engineering or science.

J.A. Glassman  
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**apple computer inc.**





I/O, continued...

## Paper Training

READY.

```
10 REM *** IF YOU'RE A HUMAN, START AT LINE 30
20 GOTO 370
30 DEAR CC:
40
50 IN RESPONSE TO THE LETTER TO YOU FROM MR. CUSHING THAT APPEARED
60 IN THE SEPTEMBER 80 LETTERS SECTION, THE PET COMPUTER WILL SUPPORT
70 INDENTING THE BASIC COMMANDS WITHOUT THAT COLON STUFF.
80 YOU CAN INDENT LINES, SUCH AS THIS ONE, OR YOU CAN HAVE BLANK LINES.
90 SUCH AS LINE 40.
100
110 THE WAY TO DO THIS IS THIS:
120 FOR 'BLANK' LINES, PUT LINE NUMBER, A SHIFTED GRAPHIC SYMBOL OR
130 A LOWER CASE LETTER, A COUPLE OF SPACES, AND ANOTHER SYMBOL.
140
150 FOR A INDENTED LINE, PUT THE LINE NUMBER, A SHIFTED SYMBOL, AND THEN
160 SPACE OVER AS FAR AS YOU WISH.
170 THIS DOESN'T EFFECT THE RUNNING OF A PROGRAM, AS CAN BE SEEN BY
180 RUNNING THE PROGRAM AT THE END OF THIS LISTING.
190
200 USING THE TOOLKIT TO RENUMBER YOUR PROGRAM DOESN'T CHANGE YOUR
210 FORMATTING. EDITING A EXISTING INDENTED LINE WILL WIPE OUT THE
220 FORMATTING UNLESS YOU PUT BACK THE SYMBOLS.
230
240 THE BEST WAY TO FORMAT A PROGRAM IS TO WRITE THE PROGRAM NORMALLY,
250 USE THE 'INST' KEY TO MOVE THE LINE OVER, AND THEN INSERT THE SYMBOL.
260
270 EASY AS PIE!
280
290 AND IN RESPONSE TO ANOTHER LETTER FROM MR. LETH, THE 03 ROM FOR
300 THE 2822 PRINTER INDEED DID HAVE PROBLEMS. HOWEVER COMMODORE'S 04
310 ROM, WHICH WAS SUPPOSED TO CORRECT THESE PROBLEMS, DIDN'T WORK
320 EITHER! IN FACT, IT CAUSED MORE PROBLEMS THAN IT SOLVED. COMMODORE
330 HAS GONE BACK TO THE OLD 03 ROM UNTILL A NEW ONE CAN BE DESIGNED.
340 I'M STILL WAITING FOR MY NEW ROM. (THE 05)
350
360
370 OPEN 4,4
380 FOR I=1 TO 5
390 FOR J=0 TO 4
400 PRINT#4,I+J;;
410 NEXT J
420 PRINT#4
430 NEXT I
440 CLOSE#4:END
450
460
470
480
490
500
READY.
```

DAVID M. CONLEY  
10571 KERRIGAN CT.  
SANTEE, CA 92071



## New Deal

Dear Editor:

I am writing because I am flabbergasted by the inappropriateness of the solution given to the puzzle "It's in the Cards" in the October issue of *Creative Computing*.

Note that I did not say the solution is incorrect—it's just that a magazine devoted to computing ought to have presented a solution which is more natural to its environment.

My point is this: The puzzle is a natural representation of integers in binary notation. One can look at the cards as being constructed as follows. Card I contains all integers whose binary representation contains a 1 in the units (rightmost) position and is headed by number 1. Card II contains all integers whose 2's position (2nd rightmost) contains a 1 and is headed by number 2, etc.

Schematically, we may look at this as in the following example for the number 113 whose binary representation is 1110001.

VII	VI	V	IV	III	II	I
1	1	1	0	0	0	1

Hence the number appears on cards I, V, VI, VII leading to the equation  $113 = 64 + 32 + 16 + 1$ .

Incidentally, isn't the fact that any positive integer can be represented uniquely as a sum of distinct powers of 2, what the binary representation is all about?

N.S. Mendelsohn, Head  
Department of Mathematics and Astronomy  
The University of Manitoba  
Winnipeg, Canada R3T 2N2

## Bally Who?

Dear Editor:

I know of two active Bally home computer clubs. They help to disseminate programs written for Bally's limited storage memory, and both plan to overcome this shortfall by custom made external add-on units to be offered to the members in the near future.

I personally think the Bally unit has great potential and hope that Bally Mfg. will offer the add-on memory with Z-Grass graphics in Rom or software.

The Bally computer clubs are:

Arcadian  
c/o Robert Fabris  
3626 Morrie Dr.  
San Jose, CA 95127

Cursor For Bally  
P.O. Box 266  
No. Hollywood, CA 91603

David R. Smikle  
4553 Pinedale  
Drayton Plains, MI 48020



## Around and Around

Dear Editor:

In an article in *Creative Computing* ("Infinite Loop Finders Revisited," September 1979) I asked the question: "Is there anywhere, out there in the world, a *practical* infinite loop finder? If so, let me hear from you." Sure enough, Jan Hajek, who is at the Computer Center at Eindhoven (the Dutch technological institute which is the home base of Edsger Dijkstra, of structured programming fame) has written to me that APPROVER, a program of his, finds many kinds of infinite loops. Interested readers might write to him at THE-RC, P.O. Box 513, Eindhoven, The Netherlands.

W.D. Maurer  
Professor  
George Washington University  
S.E.A.S.  
Washington, D.C. 20052



## Point/Counterpoint

Dear Editor:

I was excited to see the article in the August '80 issue about pie graphs. I have been working out some graphing programs for the Apple lately. The one problem that the author said he had was that when he plotted some colors next to each other (He gave the example of orange and green) he got strange results, and his dealer did not explain the cause of this in full detail.

The reason is as follows: each byte in hi-res represents 7 dots in black and white, or 4 dots in color. They are arranged like this (From MSB to LSB)

C d d d d d d d ,

where each "d" is one of the points on the screen, and the "C" is the color group mask. If it is a zero then the dots in that byte can only be black (0), white (3), green (1), or purple (2). If this bit is a one then the dots can only be black (4), white (7), orange (5), or blue (6)! By plotting a dot in the higher color group on a byte which is presently in the lower group or vice-versa, any previous dots were changed to a different color. I believe this is what the dealer referred to as color flip, and as far as I know there is no way to get around the problem.

I hope this cleared up any problems that Apple users have with this oddity. Keep up the good work.

Mark Kriegsmann  
103 Crest Dr.  
Summit, NJ 07901



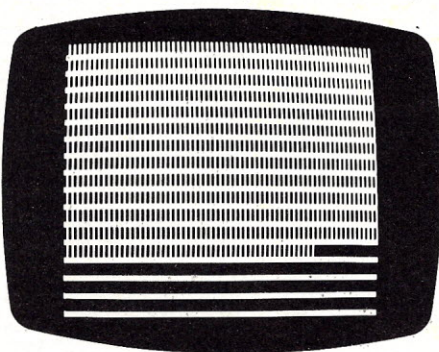
## Fast Poke

Dear Editor:

Here is a dandy little graphics demo for the Level II TRS-80:

```
10 CLS: CLEAR
20 FOR A=129 TO 255
30 FOR X=15360 TO 16383
40 IF INKEY$="S" THEN 200
50 IF INKEY$="C" THEN CLS
60 POKE X,A
70 NEXT X
80 X=0:NEXT A
90 CLS:INPUT"AGAIN (1/2)";AG
100 IF AG=1 THEN 10 ELSE END
110 REMARKABLE, HUH?
200 IF INKEY$="R" THEN 50 ELSE 200
```

By poking into memory locations 15360 through 16383 we access the screen memory (each location in the screen memory represents a position on the video monitor). We poke the TRS-80 CHR\$ codes for graphics. The result is that the entire screen becomes filled with a pattern of graphics corresponding to the CHR\$ code, then starts again from the top with a new pattern.



A few extra include:

1. Pressing "S" will halt program execution if you enjoy the current pattern.
2. Hitting "R" will start up where you left off before you hit "S".
3. Hitting "C" will clear the display and then continue on with the main program.

Jimmy Berkley  
16 Fordham Road  
Livingston, NJ 07039



## Language Barrier

Dear Editor:

I have been a faithful subscriber to *Creative Computing* for some time now and have found a number of useful tips & programs for my TRS-80. However, I also use a Nova-3 at work and it can only run Fortran programs, which I cannot remember ever seeing in your magazine. Is there someplace where I can get some good Fortran programs for the Nova computer? (This is ANSI standard Fortran).

J.R. Fitzsimmons  
Box 521 Star Rt.  
Earleton, FL 32631

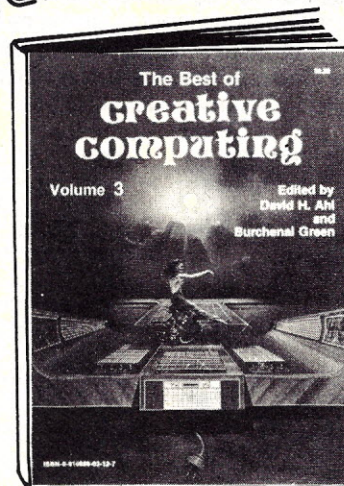
*From time to time Creative has run programs in Fortran, for example "On Solving Alphametrics" by John Beidler, "Othello" by Ed Wright and several others. However, on surveys, reader response to Fortran pieces has been less-than-overwhelming to say the least. Hence, we've been running very little lately.*

—DHA

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## EIDOS SYSTEMS

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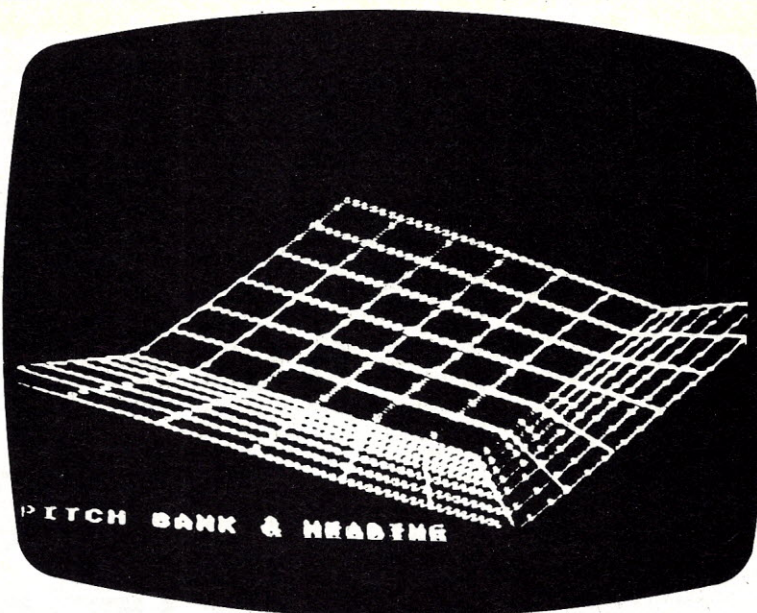
Barring plague, famine, or a chromium-oxide shortage, this will be a regular feature, acting as a catch-all for reviews of software, bits of news, and whatever else seems worth passing on. This month, a tough game, a good utility, and a taxing program.

### 50 Ways to Leave Your Life

**Med Systems Software**, P.O. Box 2674, Chapel Hill NC 27541, has come out with *Deathmaze 5000*, a tape for a 16K TRS-80 (\$12.95). They are also working on a 32K Apple version that will run on either Apple. The game is an adventure that takes place in a large maze of corridors with five levels. The display consists of nicely-done three-dimensional graphics of the sort used in *Tunnel Vision*. Since the program is written in machine language, the screen changes almost instantly as you walk through the corridors. The player can either move through the maze using arrow keys, or give two-word commands such as "Take knife." Throughout the corridors, there are boxes containing objects. The purpose of the game is to get out alive. This is not an easy task; there are many ways to get beheaded, smashed, crushed, or otherwise removed from play. The game can be saved on tape. Unfortunately, attempts to reload the data left me in other areas of the maze. Despite this, the game is very good, though I still haven't figured out how to progress beyond the first level. Med Systems had graciously provided all the instructions necessary to let you put the game on disk. They haven't provided instructions for how to get past the first level. Such is life.

### A New Perspective

An excellent utility for the Atari is *3-Dimensional Computer Graphics* (\$29.95), which will run on either the 400 or 800. From **Sebree's Computing**, 456 Granite Ave., Monrovia CA 91016, the set of four programs allows the drawing of wire-frame type objects. The objects can be viewed at different angles, moved along any of the coordinates or rotated. The programs run with as little as 8K, but higher resolutions require more memory. The first program demonstrates the abilities of the system, allowing the user to input x,y, and z coordinated as well as pitch, bank, and heading. Then a prestored figure is drawn. The second program allows you to define figures. The last two programs demonstrate ways to incorporate the drawings into full scenes. Whether you just want to play



## Soft Centered

**David Lubar**

around with three-dimensional drawing, or need a graphics utility for working with solid objects, this package is worth considering.

### Giving Sam His Dues

**Micromatic Programming Company**, 24 Old Farm Road, Weston CT 06829, sent me a demonstration sample of their *Tax[Saver]* program, which will be released this January as a set of disks or cassettes for the TRS-80. While the sample didn't contain the full series of programs, it had enough to show that *Tax[Saver]* is well designed and easy to use. Basically, the user is asked a series of questions, allowing the program to determine such things as filing status, required forms, etc. You have to have all the necessary information on hand. The program has some nice features. For instance, it will inform you if your employer is deducting too much for Social Security. If you are filing a joint return, it will ask if you also want to try doing forms for filing separately, thus allowing you to determine which way costs less. At various points, tricky questions are explained, either in the manual or in the program. For example, if you want to declare dependents, there is a program that helps you determine whether each individual in question can qualify as a dependent. Once all data has been entered, the program displays each line of the appropriate form and shows what should be entered in that line.

Obviously, not everyone needs this type of help. If your return is very simple, there isn't much for the computer to do. And if

your return is very complicated, you probably have an accountant. But if you are somewhere in the middle, and the thought of filling out those forms sends shivers through your body, this program could ease the painful process of paying Uncle Sam.

### Scattered Bits

It seems that the shortage of Atari software is coming to an end. Many companies are moving into this area, both with conversions of existing programs, and with original material. At a slower rate, the same thing is happening for the TI 99/4. TRS-80 owners will be pleased to learn that **Adventure International** is working on a new series of games which combine Adventure with Dungeons and Dragons. The first game of the series will require dual disks, further releases will run on smaller configurations. These will be reviewed as soon as they are available. The first American software for the Sinclair ZX 80 should be hitting the market soon, courtesy of **Image**. Several new releases from **Creative Computing** will be available in the near future, including an excellent version of *Milestones* for the Apple.

### Parting Words

The problem of software piracy affects everyone who is involved with computers. A related issue is protected software. How do you, the users, feel about uncopyable programs? Are there alternatives? Would you rather pay more and receive a copyable program? Your thoughts are welcome. □



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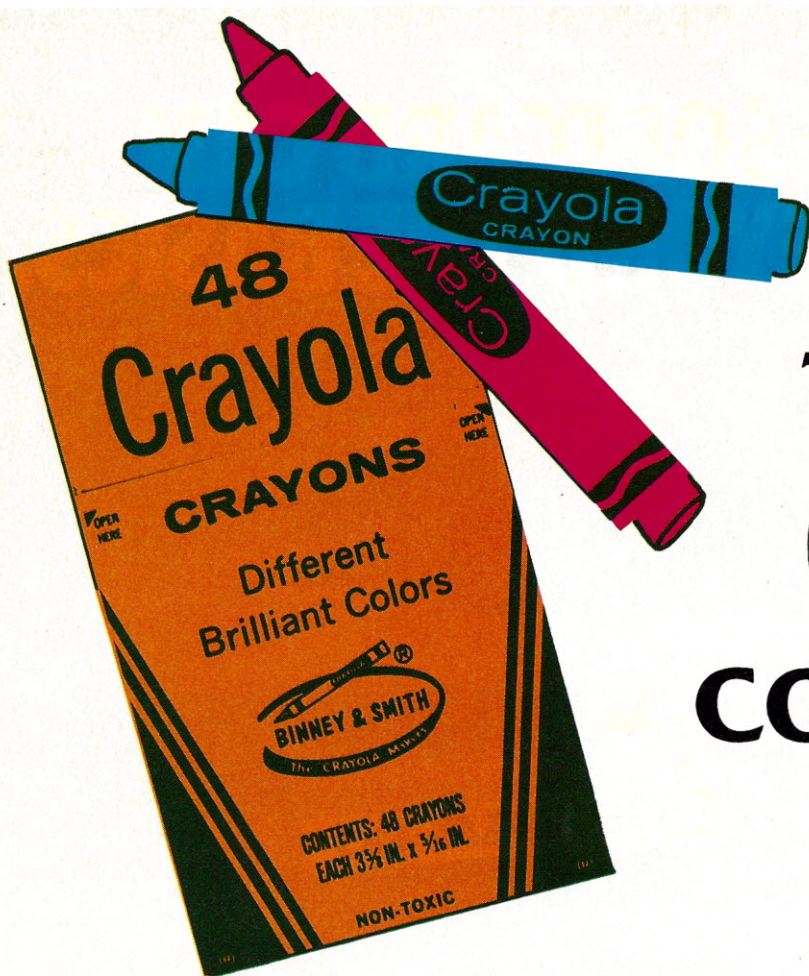
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# TRS-80 COLOR COMPUTER

**James Garon**

## Documentation

Three pieces of documentation come with the computer: A 151 page beginner's book called *Getting Started With Color Basic*, A 31 page *Color Computer Operation Manual*, and a Quick Reference Card.

*Getting Started With Color Basic* is an excellent introduction to Color Basic. While it does not attempt to cover all aspects of programming, or even the complete instruction set of Color Basic, it does take a core vocabulary and explain it well. The style is similar to Learning Level I; there are abundant humorous illustrations, clear examples, and well-thought-out diagrams which manage to convey both simple and complex concepts in a manner which will not intimidate the newcomer to computing. After a concept has been presented, the reader is invited to write a "Do it yourself program." Sample solutions are given in the text for the shorter exercises and an entire appendix is devoted to solutions to the longer programs. It is interesting to note that while semicolons are often optional in both Level II and Color Basic PRINT statements, this is the first manual that tacitly acknowledges the fact.

The *Color Computer Operation Manual* covers topics such as connecting the computer to your television, connection and use of joysticks, printer, program cartridges, and cassette recorder. Here also, the programmer already familiar with

Basic will find information on the special features of Color Basic, such as producing sounds and creating graphics.

The Quick Reference Card (8½ x 15", printed on both sides) is divided into eight sections:

- Start-UP: Tells you how to turn the system on.
- Special characters ( ' \$ : ? , ; ) all have the same meanings as in Level II.
- Operators (+, -, \*, /, AND, OR etc. indicating the order in which they are evaluated by Basic).
- Basic Functions: There are 22 functions listed alphabetically, from ABS to VAL.)
- Control Keys: There are eight, seven of which the Level II programmer will be familiar with; left-arrow to erase one character, shift-left-arrow to erase a line being typed, BREAK, CLEAR, ENTER, the spacebar, and SHIFT-@ to halt a listing or program execution until another key has been pressed (unlike Level II however, you must use a key other than SHIFT-@ to resume a listing or halted program). The eighth control key is SHIFT-0 which is used to toggle back and forth between upper and lowercase (lowercase is shown as reverse video uppercase: black letters on a green background. These reversed characters will appear as lower case on a lineprinter).
- Basic Statements: 41 statements, again listed alphabetically, from AUDIO to STOP.
- Video Control Codes (there are only three:

decimal 8, 13 and 32 which perform similarly to their Level II cousins: backspace and erase, linefeed and carriage return, and a blank.

•Error Messages: there are 25 2-character codes.

In addition to the above, there are only three more items in the box: a 12 foot cable for connecting the computer to your television set, a switch box that allows you to select either the computer signal or television programs, and the computer itself.

The computer is attractively styled in silver and black with simulated mother-of-pearl and colored accents.

The only cause for complaint might be the keys themselves, which look and sound much like rectangular pieces of hard candy or gum; however, after a few minutes of typing one gets used to their feel and their clatter. The keys are color-coded; most keys are gray, the control keys are white, and the powerful BREAK key is red.

In the rear of the cabinet are five jacks, two buttons, a switch, and a power cord. One jack accepts the cable which carries sound and picture to your television. The next jack is for the optional CTR-80A recorder cable. (The cable from a regular TRS-80 recorder will not fit here.) The third jack is for an RS-232-C device such as a serial printer or possibly a modem. The last two jacks accept one joystick each.

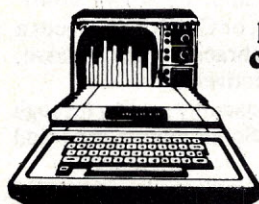
The two buttons are located at either



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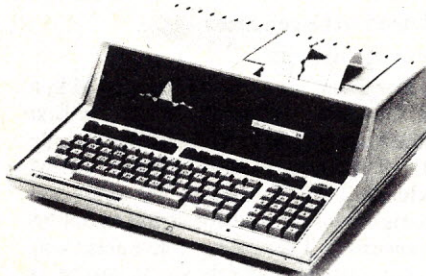
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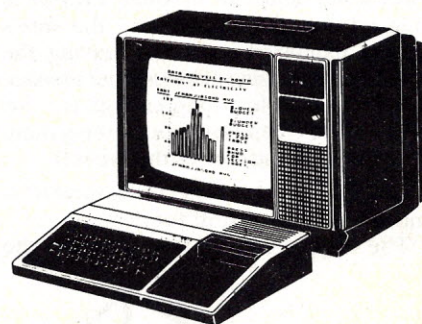
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## TRS-80 Color, continued...

side of the back panel; one is the power switch, the other is the RESET button. Both are safe from accidental pressing, yet easily accessible without having to be a finger-contortionist as is necessary with the original TRS-80. The switch allows the selection of television channel 3 or channel 4, whichever is weakest in your area.

The power cord is just that—a power cord; there is no awkward power supply enclosure to clutter your work area as there is with the original TRS-80. It has a three prong, grounded plug which caused a few brief moments of panic since our eight year old New Hampshire apartment, while it has many outlets, has only one three-holer and the original TRS-80 is plugged into that! Borrowing the wife's ironing extension cord and leaving the ground plug hanging helplessly out in space solved the problem long enough for this review to be completed. (Good thing there were no lightning storms this week!)

Let's look at some negative features first, and save the good stuff for dessert:

The display format is very small; the

will find this difficult to remember at first, Color Basic does not recognize the word "LET." This means that you must replace lines such as:

```
10 LET A=7
```

with:

```
10 A=7.
```

Since most programmers do not use the word "LET" anyway, this is not a particular hardship. The word "THEN" may not be omitted (or replaced by a comma). A line such as:

```
10 IF X=Y PRINT "YES"
```

will need to be rewritten:

```
10 IF X=Y THEN PRINT "YES"
```

Color Basic uses a lot of user RAM in a "4K" machine. When the system is first turned on, typing PRINT MEM yields only 2343. Typing CLEAR 0:PRINT MEM produces 2543. Evidently 200 bytes are automatically cleared for string variables on power-up. There is no convenient way to find out how much string space is available (there is no FRE command).

DEFINT, DEFSGN, DEFDBL, and DEFSTR are all absent. If a variable (one or two characters, the first of which is a letter, the second either a letter or number) is followed by a "\$" it is a string variable, otherwise it is a numeric variable. Numeric variables are stored as 5 byte floating point

numbers (compared with 4 bytes for single precision and 8 bytes for double precision in Level II). This results in 9-digit accuracy whether you need it or not.

Also missing are: VARPTR, STRING\$, COS, ATN, LOG, EXP, the up-arrow which allows raising a number to a power in Level II, and the ON ERROR GOTO instruction.

So much for the drawbacks.

## Further Facts

Holding the shift-key while simultaneously pressing either up-arrow, down-arrow, right-arrow, or CLEAR produces a left arrow (!?), left bracket, right bracket, or backslash respectively.

The cursor is constantly cycling through the eight colors. Some people may find this annoying.

Screen memory begins at location 9216 (decimal) and continues for a total of 512 locations. Surprisingly, it also begins at location 25600. PEEKs from and POKEs into either block of memory produce identical results. Figure 1 is a program which POKEs the entire Color Basic character set onto the screen.

Figure 1

```
10 S=9216+64: 2ND LINE OF SCREEN
```

```
20 CLS:FOR I=0 TO 255
```

```
30 POKE S+I,I:NEXT
```



TRS-80 Color Computer

screen can display only 512 characters in 16 rows of 32.

There is no way to edit a line once it has been entered other than by retyping it. While a line can be as long as 249 characters, most programmers will not want to pack a line this tightly since a single typing error will require that the entire line be retyped.

Variables on either side of the word "TO" in a FOR/NEXT loop must be separated from that word by at least one space:

```
10 FOR I = A TO B
```

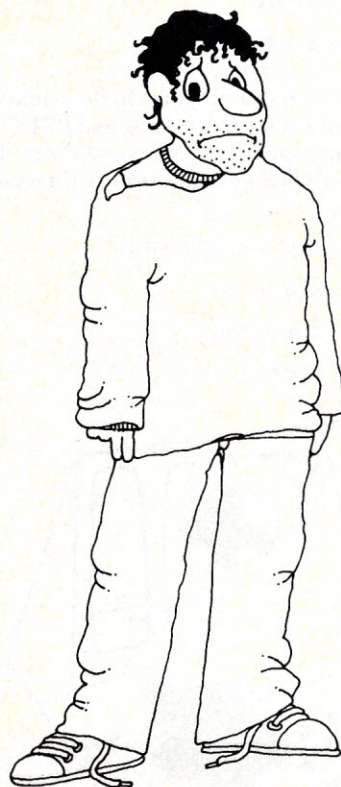
will not work properly. Instead, use:

```
10 FOR I = A TO B
```

Those who are used to the compressed form (without spaces) allowed in Level II



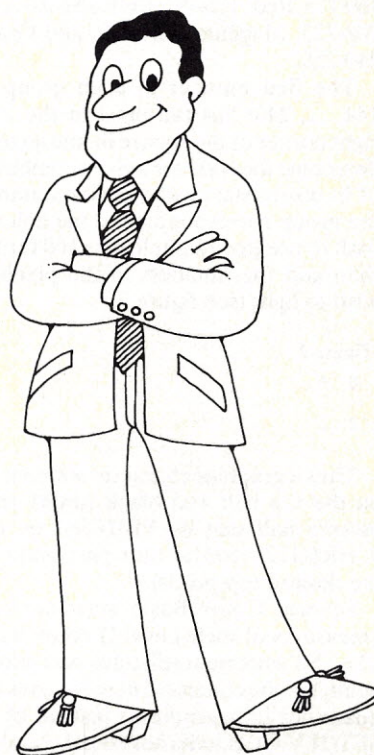
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## TRS-80 Color, continued...

The results show that 0 through 127 are upper and lowercase characters (lowercase is shown as reverse-video uppercase, but will appear as lowercase on a printer), while 128 through 255 are graphic characters—16 graphic characters for each of the eight colors:

Green: 128-143, Yellow: 144-159, Blue: 160-175, Red: 176-191, Buff: 192-207, Cyan: 208-223, Magenta: 224-239, and Orange: 240-255.

The first number in each group 128, 144, ..., 240) has the pixel in the lower-right corner of the square lit and so on. To determine the code for a given combination of lit pixels, start with the first number in the group corresponding to the color you wish to use (for example, use 160 for blue) then add the numbers in the pixels you wish to light (see figure 2).

Figure 2

```
8 4
2 1
```

Thus a graphics character which is blue on the top half and black (unlit) on the bottom half can be PRINTed by using (CHR\$(172)) (160 for blue plus 8 and 4 for the desired top pixels).

Several Color Basic statements are extensions of their Level II counterparts. The SET statement still turns on a graphics point, but the command now contains three quantities in parentheses instead of two: SET(H,V,C). H is the horizontal coordinate and may range from 0 to 63; V is the vertical coordinate any may range from 0 to 31; C is the color of the point and may be any number from 0 to 8, each of which represents a different color. Thus the resolution of the screen is 64 x 32 or 2048. This is one-third the resolution of the Level II screen. As noted earlier, there are four pixels in each PRINT @ position. All "lit" pixels in a given PRINT @ position must be the same color. If you SET one of them green, and later SET another one red, the pixel which was SET first will also become red.

CLS, the command used to clear the screen, may be followed by a number from 0 to 8. Each number clears the screen to a different color. (CLS 9 clears the screen to the default color green and then prints the word "MICROSOFT"!).

POINT(X,Y) returns a value from 0 to 8 depending on the color of the pixel at X,y. If a character is present at the PRINT @ position containing X,Y then POINT(X,Y) will equal -1.

CLEAR can be followed by one or two quantities. The first, as in Level II, sets aside string space. The second (if used) is the highest address Basic can use (similar to MEMORY SIZE or MEM SIZE in Level II, but can now be easily altered without having to simulate power-up conditions.)

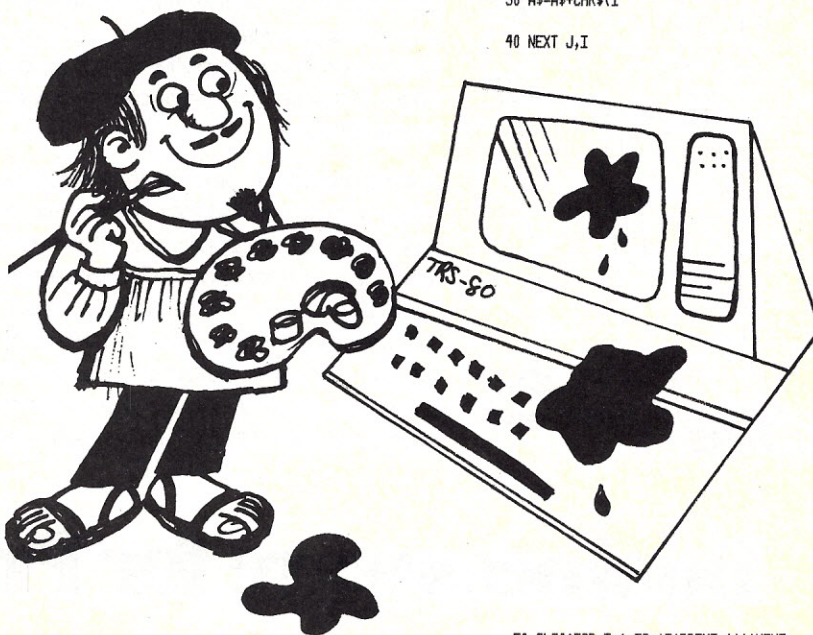
CLOAD functions the same as it does in Level II, but will accept program names up to eight characters long.

CLOADM loads a machine language program from tape. If a number appears after the filename as in:

```
CLOADM"PROG",1000
```

the normal loading address will offset by that number.

Level II programmers can say goodbye to machine language sound routines. The SOUND P,T statement can produce a note within a range of four full octaves (as P varies from 1 to 255) while T controls the duration in increments of six hundredths (.06) of a second. An appendix in *Getting Started With Color Basic* shows values to use for P to obtain any of the notes contained in the four octaves.



### A Question Of Speed

As with Level II, there are ways to speed up your graphics (although none are mentioned in either manual). These methods are similar to their Level II counterparts: POKE graphics and string graphics. In the Color Computer Operation Manual there is a Color Adjustment Test program which draws 8 vertical color bars. This is to allow you to adjust your television so that it will display the proper colors. The program uses SET graphics and takes over 33 seconds to fill the screen (No listing of the program is given here in order to comply with a rather ferocious warning in the front of the manual against reproducing any of the contents; however, I think I'm safe in passing along the information that it consists of 6 short lines.) Figure 3 gives a routine to display the same 8 color bars, but using POKE graphics instead of SET. This cuts the time in half (about 16 seconds).

Figure 3

```
10 FOR ROW=0 TO 15
20 FOR COL=0 TO 31
30 P=143+16*INT(COL/4)
40 POKE 9216+32*ROW+COL,P
50 NEXT:NEXT
60 GOTO 60
```

Figure 4 is a program to do essentially the same thing by creating and PRINTing the appropriate string several times. This method takes about two-thirds of a second!

Figure 4

```
10 FOR I=143 TO 255 STEP 16
20 FOR J=1 TO 4
30 A$=A$+CHR$(I)
40 NEXT J,I
```

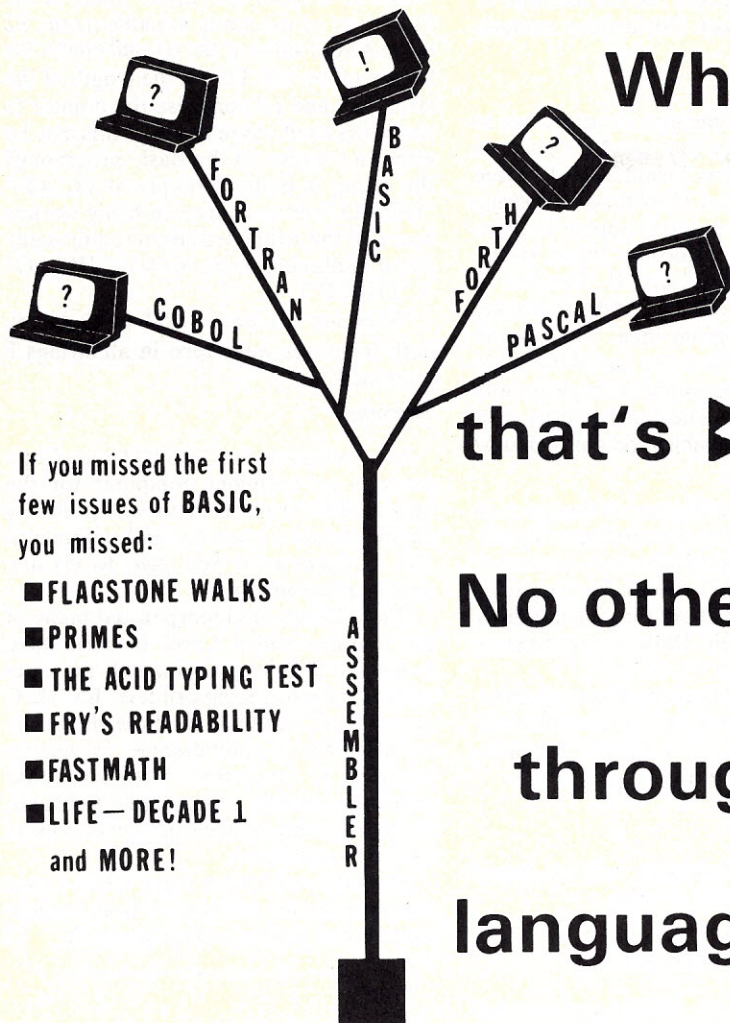
```
50 CLS0:FOR I=1 TO 15:PRINT A$;:NEXT
60 GOTO 60
```

### Cassette Operation

Both manuals strongly recommend the use of Radio Shack's CTR-80A recorder for use with this computer. The first thing I did was attempt to connect my ancient CTR-41 (which came with my original 4K Level I TRS-80) to the Color Computer. No luck. The jack on the back of the computer is slightly smaller than the DIN connector. Therefore the following information has not been verified.

CSAVE and CLOAD operate 1500 baud; three times faster than Level II. Files may be given names up to eight characters long. The SKIPF "NAME" instruction causes the tape to be advanced to the end of a program called NAME. There are commands to turn the MOTOR ON and MOTOR OFF, and there is a command called AUDIO which is supposed to send the sound on a cassette to your television





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## TRS-80 Color, continued...

speaker. This offers the possibility of combining music, speech, etc. with Basic programs.

### Program And Other Storage

(The following information is of a more technical nature. It was discovered by this reviewer and is subject to change pending the observations of others.)

The program in Figure 5 will list all the keywords in Color Basic, along with their one- or two-byte decimal tokens.

Figure 5

```
2000 X=128:PRINT X;
2010 FOR I=43622 TO I+255:M=PEEK(I)
2020 IF M<128 THEN PRINT CHR$(M);:GOTO 2050
2030 PRINT CHR$(M-128),:X=X+1:IF X<181 THEN PRINT X;:GOTO 2050
2040 PRINT " 255";X-53;
2050 NEXT
```

Table 1 gives the decimal token values of the Color Basic instructions. If there are two words for a given number, the second word (usually a function, which means: immediately followed by one or more items in parentheses) has a two-byte token: the first byte is 255 and the second byte is the same as that for the first instruction. For example, the instruction FOR is stored as 128 while the SGN function is stored as 255 followed by 128. There are many instructions which are familiar friends from Level II (and even a few reminiscent of Disk Basic such as OPEN and CLOSE). Some instructions are sadly absent (the loss of STRING\$ and VARPTR grieved me the most) and some new instructions have been introduced.

Table 1

128 FOR	SGN	146 POKE	INKEY\$	164 TAB(
129 GO	INT	147 CONT	MEM	165 TO
130 REM	ABS	148 LIST		166 SUB
131 '	USR	149 CLEAR		167 THEN
132 ELSE	RND	150 NEW		168 NOT
133 IF	SIN	151 CLOAD		169 STEP
134 DATA	PEEK	152 CSAVE		170 OFF
135 PRINT	LEN	153 OPEN		171 +
136 ON	STR\$	154 CLOSE		172 -
137 INPUT	VAL	155 LLIST		173 *
138 END	ASC	156 SET		174 /
139 NEXT	CHR\$	157 RESET		175 (up-arrow)
140 DIM	EOF	158 CLS		176 AND
141 READ	JOYSTK	159 MOTOR		177 THEN
142 RUN	LEFT\$	160 SOUND		178 >
143 RESTORE	RIGHT\$	161 AUDIO		179 =
144 RETURN	MID\$	162 EXEC		180 <
145 STOP	POINT	163 SKIPF		

This reviewer could find no mention of the word SUB (token 166) in either manual.

### Going Deeper

The following memory locations are in decimal. There are four two-byte pointers starting at locations 25 and 26 and ending with locations 32 and 32. With one surprising difference, these pointers appear to serve the same purpose as those at 16548, 16623, 16625, and 16627 in Level II. The first of these contains the address of the beginning of the Basic program area. The second pointer indicates both the end of the Basic program and the beginning of simple (unsubscripted) variables. The fourth pointer gives the end of array variables and the beginning of free memory.

The surprising difference is that each of these 2-byte pointers is stored most-significant first, least-significant-byte second—just the opposite of Level II. For example, in location 25 and 26 we find the numbers 6 and 1 respectively. Basic programs start at location  $6 \times 256 + 1$  or 1537.

Except for this difference, Basic programs are stored in essentially the same internal format as they are in Level II. For example, if the one line program

10 REM

is entered, the following will be found from locations 1537 to 1544:

6, 7, 0, 10, 130, 0, 0, 0

The first two bytes, when interpreted as a pointer (again in the order MSB, LSB) give 1543. This is the address of the beginning of the next line, if there is one, or a pointer to two consecutive zeros, as in this case, to indicate the end of the program.

The next two bytes, 0, 10, are the line number:  $256 \times 0 + 10 = 10$ .

130 is the token for REM. The next byte (0) signals the end of the current line.

Immediately following the program, the simple variables are stored. Numeric and string variables each take seven bytes. A numeric variable such as G1 is stored as:

N1, N2, B1, B2, B3, B4, B5

Where N1 is the ASCII value of the first letter of the name ( $\text{ASC}("G") = 71$  in this case), N2 is the ASCII value of the second character ( $\text{ASC}("1") = 49$ ) if there is one, or zero in the case of a one-letter name. B1 through B5 are the floating point representing of the actual value of the variable. A discussion of floating point numbers is beyond the scope of this review.

String variables are stored a little differently:

S1, S2, LEN, U1, L1, L2, U2

While S1 is again the ASCII value of the first letter of the string variable name, S2 is the ASCII value of the second character increased by 128. LEN is the length of the string, L1 and L2 comprise the pointer to the string itself. As in Level II, this may be either a location in the Basic program (if the string is defined simply as in:  $A\$ = \text{"HELLO"}$ ) or an address in string storage space (if the string definition requires any string manipulations as in:  $A\$ = \text{"HELLO"} + \text{"THERE"}$ ).

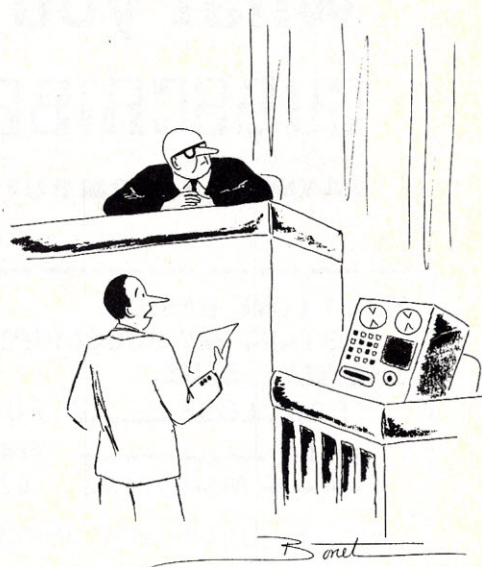
What are U1 and U2? I don't know. Both locations were zero in all strings I examined.

### Summary

In conclusion, the TRS-80 Color Computer is an excellent computer for the under \$400.00 price. You will probably decide to add a recorder and upgrade to 16K of memory if you plan to do any serious programming.

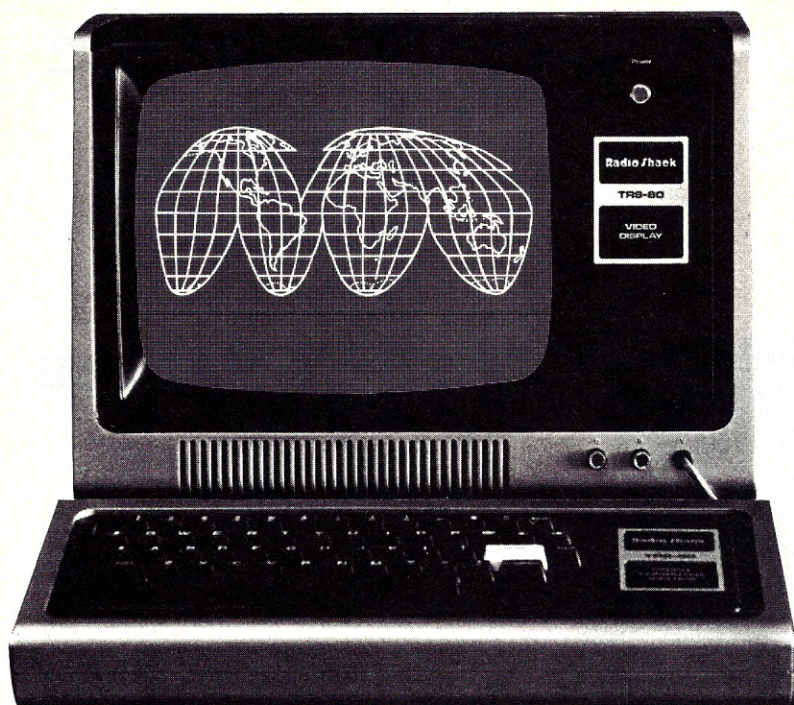
Radio Shack has incorporated many of the features which Level II users have requested in the past. Since all the electronics for interfacing printers, RS-232-C devices, etc. are built in, there should be no need for a cumbersome expansion interface in the future. With lowercase printing capability as standard equipment, another complaint of earlier Level II users has been addressed.

My wife and I were sorry when it was time to return the computer to work because we enjoyed playing with it so much. □



"And in what manner did the defendant strike you after you placed him in checkmate?"





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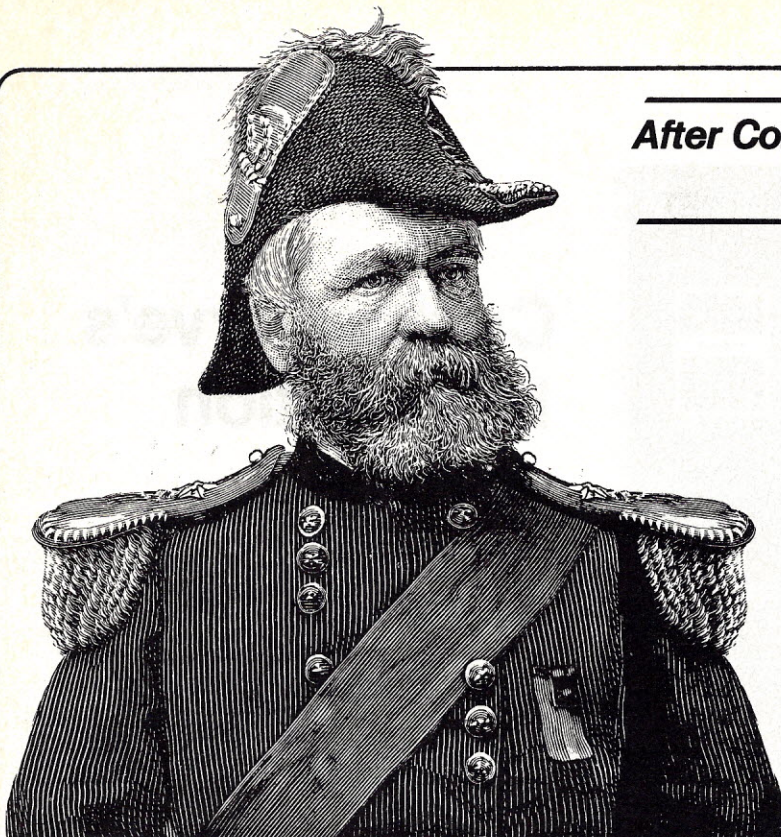
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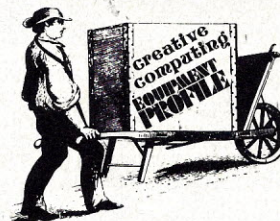
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CIRCLE 134 ON READER SERVICE CARD





## After Conquering Britain, Commodore Sets Sail for the Colonies



## No PET Peeves

**Peter Fee**

*Commodore wants you.* That in itself is not news; Apple, Atari and Radio Shack want you, too. What *is* news is that Commodore now feels that it has the means to re-establish its lead in the American market—and it wants that more than anything. After a few years of taking a back seat to the leaner, meaner competition, Commodore is about to introduce its new home computer—the VIC 20.

This past September 30th I attended a rather hastily called press conference at New York's "fashionable" Four Seasons, hoping to get a firsthand look at the VIC. Normally one would expect a Commodore conference to be attended almost exclusively by the computing press; instead, I felt as if I'd walked onto the floor of the Stock Exchange. Though the meeting had ostensibly been called to announce Commodore's new line-up, there was another reason behind it. Commodore stock had been (and still is) going right through the Wall Street roof. The Securities and Exchange Commission was rumored to be very interested in this development (unlike most rumors, this one turned out to be true) and so, the main purpose of the conference was to show key security analysts that there was a reason for all the excitement.

Apart from the introduction of the new equipment (Oh yes, I *will* be getting to that), Commodore also talked about their plans to back it up. Among the artillery: an advertising budget of between five and eight million dollars and a pledge to improve the network of 500 or so PET dealers by providing them with more service and software support.

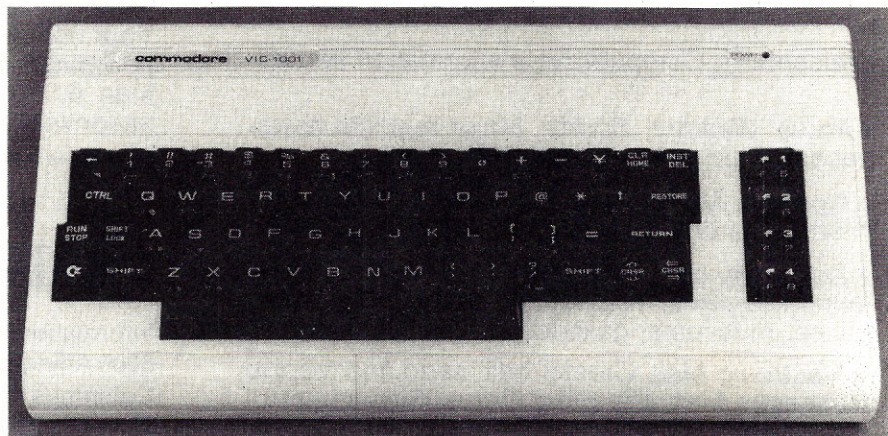
When Commodore talks about the com-

petition, they speak less of Apple and Radio Shack than of the Japanese companies they believe will try to dominate the market. Commodore has decided to take the offensive, introducing the VIC 20 in Japan as the VIC 1001 (pictured here—note the Japanese characters on the keyboard). Apparently Commodore seems determined to learn the lesson GM, Ford and Chrysler learned too late; the only "K" Commodore has to push is in the VIC 20.

But enough of that; let's get to the goodies. The VIC 20 offers: color, sound, programmable function keys, 5K RAM with memory expansion to 32K, 6502 microprocessor, full-size typewriter keyboard, external expansion ports, 22 character by 23 line screen display, high resolution graphics, graphics character set, external plug-in memory and program cartridges, joystick/paddles/lightpen and standard PET Basic. Taken separately, none of these features are particularly new; but put them together, and you haven't got a bad little machine.

In case you're wondering, VIC stands for Video Interface Chip, which incorporates RAM, ROM and video control circuitry all on the same chip. It was the development of this chip that allowed Commodore to reduce the total number of components needed to build the VIC 20.

But what does this have to do with the price of computers? Everything, and more. When the number of components is reduced, the price is also reduced, and you have a revolution on your hands. The VIC 20 will sell for only \$299; how long before an equivalent computer sells for under \$200? At the VIC's price, the home computer can be to the American family of the 1980's what the television set was to the American family of the 1970's (without the mind-numbing effects, of course. You won't be able to watch *I Love Lucy* reruns on your PET). A high quality machine at a low price will change things so fast you might miss it even if you *don't* blink.





The most important question here is: Is the VIC 20 a high-quality machine at a low price? Well, \$299 is an *incredibly* low price. As for the high quality, I can't answer that yet. Though I did see the VIC in action at the Commodore press conference, I never got the chance to play with it myself. An Apple, an Atari, and a TRS-80 were on hand "to show the superiority of the VIC 20," but unfortunately the promised comparison never materialized. The VIC will be formally introduced at the Consumer Electronics Show in Las Vegas in early January, and will go on sale immediately thereafter.

The VIC is not all Commodore has to offer. A new single floppy disk unit, the CBM 2031, is being introduced, with a serial-bus version for the VIC to follow. Both the CBM 2031 and the 2031S will sell for under \$600.

Commodore will also be marketing the CBM 8096, a 96K version of the 8032 80-column business computer. This expansion in internal storage capacity would double the amount of RAM in a 32K computer and permit large programs to reside in and cycle through the expanded memory space. The price of the 8096 has not yet been announced.

The Wordcraft 80, Commodore's new wordprocessing system, could establish the

company in that field. The Wordcraft 80, combined with a Commodore business system, would sell for about \$5000, another price breakthrough.

Commodore's big surprise is its line of cash register computer systems, which combine computerized business record keeping with conventional cash register

***A high quality machine  
at a low price  
will change things  
so fast you might miss it  
even if you don't blink.***

devices. Three separate systems have been developed: Registers for 1) grocery and cost-plus stores, 2) restaurants, and 3) retail inventory control. Each system includes a small computer with built-in CRT display screen, receipt printer, cash draw electronically-keyed to the computer, and optional floppy disk storage unit.

I saw the demonstration of the restaurant cash register system, and I just fell in love

with it. This register does everything but tell you that the prime rib is a little fatty tonight. Using this system, a server can call up the menu list, place the customer's food and drink orders, and specify such variables as the salad dressing, a la carte items and meat preparation. After the meal, the bill can be tallied line by line for each expenditure by calling up the table number, waitress number, or ticket number. The transaction amount and amount paid are entered, and change due displayed on the screen. Total information for each order is stored on a floppy disk for subsequent data retrieval and data processing. All in all, very nice.

The question remains: Can this new equipment re-establish Commodore in America? From the standpoint of price, the answer is most definitely "yes." Commodore has shown great interest in making the home computer affordable to the middle class, as opposed to the "Let them eat cake" attitude of some companies. Investor interest also cannot be denied, as the SEC will tell you. (By the way, no irregularities were found in the matter.) The quality of the equipment is the only unanswered question, but since everything I've mentioned here is scheduled for a January 1981 release, the question won't stay unanswered for long. We'll keep you posted. □

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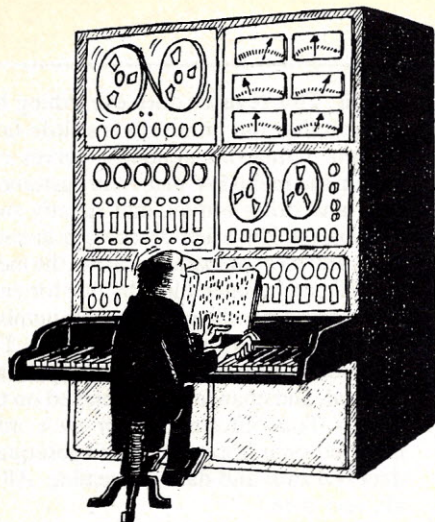
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CIRCLE 123 ON READER SERVICE CARD





# Atari Music Composer Cartridge

Leonard Nasman

*CORK*

Do you hear music inside your head, but can't play an instrument well enough to get it out? Atari has put together a tool for all of you budding Beethovens that makes musical compositions easy to create, modify, and play. The Music Composer Cartridge simply plugs into an Atari 400 or 800 ROM slot and allows a user to enter, rearrange, play, and save up to four-part harmony.

Those that are familiar with the Atari system know it to be a powerful personal computer that comes with great graphics, an expanded character set, and built-in tone generators. Atari has now added a cartridge that makes music entry easy for those who are not programming experts.

When you plug the cartridge in and close the lid the first of five menus appears on the TV screen (Atari attaches to a standard color TV with an antenna switch box similar to their video games). This first "main menu" lists; Edit music, Arrange music, Save, Retrieve, DOS, and Listen. Typing the first letter of any of the first four of these, followed by the "return" key, causes a jump to one of the four sub menus, DOS causes the disk operating system menu to be displayed (if no disk drive is attached, it will jump to "Atari memo pad"). "Listen" causes whatever music is stored to be played.

The "Edit" sub menu allows you to check measures, enter notes or change the meter, key signature or tempo. The notes are entered by selecting a phrase number (0 to 9), selecting a measure within a phrase, and typing the desired note code. Typing "C4Q" will get a C in octave 4 played as a quarter note. Typing "BF3S" will get a B flat in the third octave played as a dotted sixteenth. Typing "FS5E" will get an F sharp in octave 5 played as an eighth note. "RH" will yield a half note rest. If you can associate notes with their letter names, they are quite easy to enter.

Once you have entered the several measures of notes that constitute a musical phrase (any number of measures

can make a phrase), you jump back to the main menu and decide what to do next. If you elect to "Arrange" by typing "A" followed by the return key, the Arrange menu will be displayed. This menu provides eight options: Count, Display, Go to line, Show the arrange menu, Play phrase, Stop (return to main menu), Transpose, and Volume. Your arrangement is limited to 20 lines of these options. You can arrange up to four different voices that will play together when you enter "L" for listen.

To enter a song like the old round "White Coral Bells", you would proceed as follows:

1. Type "E" (edit)
2. Type "P" (phrase)
3. Enter phrase number "1"
4. When the prompt "Erase?" appears on the screen type "Y" (since this is a new selection we want to clear the phrase, if we only want to change something already entered we would type "N").

At this point the screen will show bass and treble clefs with key signature, meter, and a cursor, below which will be printed:

```
PHRASE 1
MEASURE 1
10232 FREE
L (A) O D (.) (T)
SMI, NOTE?
```

The first two lines show the phrase and measure you are in. The number in front of "FREE" shows how much space is left in memory. The fourth line shows the format for entering notes: L-Letter, A-Accidental, O-Octave, D-Duration, (.)-Dot, T-Tie. "SMI" in the last line is a mini menu that reminds you that you can opt to "S"-Stop (return to the edit menu), "M" select a measure, or "I" insert a measure, as well as enter a note at this point. Now back to "White Coral Bells".

5. Enter notes in measures and phrases. For this song let "White coral/bells up/on a slen-der/stalk" be four measures in phrase one, and "Lil-ies of the/val-ley deck my/gar-den/walk" be four measures of phrase two. Also, enter four measures of rest as phrase three.

6. After you have entered these three

phrases, type "S" to return to the edit menu, then "S" again to return to the main menu.

7. Now type "A" for arrange. The prompt "VOICE#?" appears. Enter "1" for the first voice. Line #1 shows "DISPLAY", and line #2 shows "PLAY PHRASE" automatically. The cursor location is identified by coloring one line blue instead of the normal white letters.

8. Arrange the four voices. To play a four part round they should look like this:

VOICE #1	VOICE #2
PLAY PHRASE 1	PLAY PHRASE 3
PLAY PHRASE 2	PLAY PHRASE 1
PLAY PHRASE 1	PLAY PHRASE 2
PLAY PHRASE 2	PLAY PHRASE 2

VOICE #3	VOICE #4
PLAY PHRASE 3	PLAY PHRASE 3
PLAY PHRASE 3	PLAY PHRASE 3
PLAY PHRASE 1	PLAY PHRASE 3
PLAY PHRASE 2	PLAY PHRASE 1
PLAY PHRASE 1	PLAY PHRASE 2
PLAY PHRASE 2	PLAY PHRASE 1
	PLAY PHRASE 2

9. Type "L" and listen to the result.

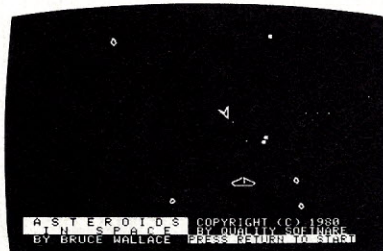
To simulate a soprano and bass voice in the arrangement, insert "T", "12" in voice #2, and "T", "-12" in voice #3 (12 half steps equals a full octave).

To save the composition, jump to the "SAVE" menu where you have the choice of saving everything, any or all phrases, or any or all voice arrangements on cassette or disk. The "RETRIEVE" menu allows the same options.

Creating your own composition is as simple as entering and manipulating phrases. Now if Atari would only add the kind of synthesizers found in electronic organs, about 32 voices, and around 200 lines for arranging, we could really compete with Bach. In the meantime, the Atari Music Composer Cartridge will be helping budding composers polish their creative skills. □



# Software for the Apple II and Apple II Plus\*

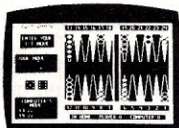


## ASTEROIDS IN SPACE™

By Bruce Wallace

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On Diskette - \$19.95



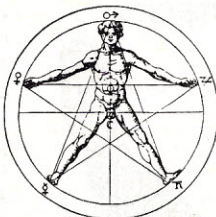
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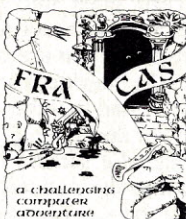
Cassette - \$19.95 Diskette - \$24.95

## ASTROAPPLE™ by Bob Male.

Your Apple computer becomes your astrologer, generating horoscopes and forecasts based on the computed positions of the heavenly bodies. This program offers a delightful and stimulating way to entertain friends. ASTROAPPLE produces natal horoscopes (birth charts) for each person based on his or her birth data. Any two people may be compared for physical, emotional, and intellectual compatibility. The program is written in Applesoft BASIC with machine language subroutines. It requires either RAM or ROM Applesoft and at least 32K of memory.



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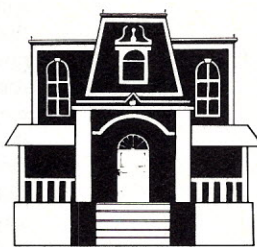
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## BATTLESHIP COMMANDER™ by Erik Kilik and Matthew Jew.



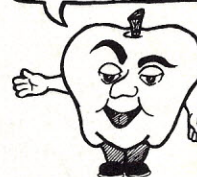
A game of strategy. You and the computer each start out by positioning five ships of different sizes on a ten by ten grid. Then the shooting starts. Place your volleys skillfully — a combination of logic and luck are required to beat the computer. Cartoons show the ships sinking and announce the winner. Sound effects and flashing lights also add to the enjoyment of the game. Both Applesoft and integer BASIC versions are included. Requires at least 32K of RAM.

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## BABBLE™ by Don Worth.

Have fun with this unique software. You write a story, entering it as a BABBLE program. As you write the story you specify certain words to be selected by the computer or entered from the keyboard at execution time. Run the program and watch BABBLE convert your story into an often hilarious collection of incongruities. The ways in which BABBLE can entertain you are limited only to your imagination. You can compose an impressive political speech or write poetry. You can plan a dinner menu. You can even form images on the screen or compose musical tunes with the help of BABBLE. The cassette version requires at least 16K of RAM and the diskette version requires at least 32K of RAM. BABBLE is written in machine language and runs on any Apple II computer.

MY SISTER'S PENCIL SHARPENER LOVES YOUR ANTEATER, AND THE CRABGRASS IS ATTACKING THE FRIENDLY MATADOR.



## BABBLE

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LINKER

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Turn your Apple II or Apple II Plus into a powerful and productive software development machine with this superb linking loader/editor package. LINKER does the following and much more:

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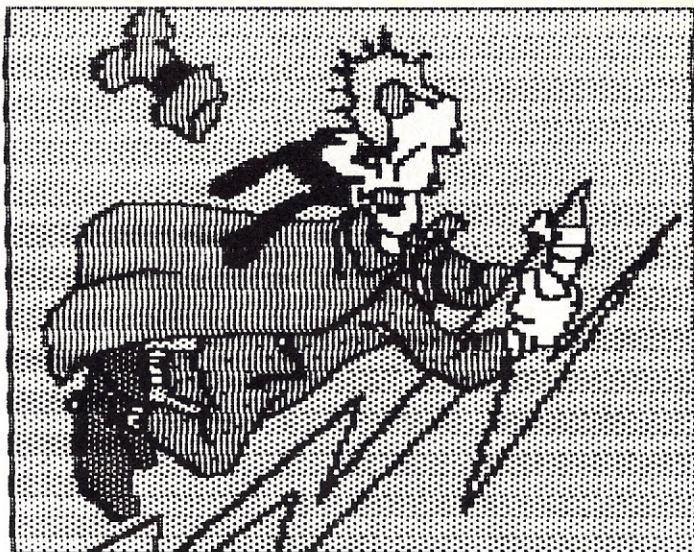
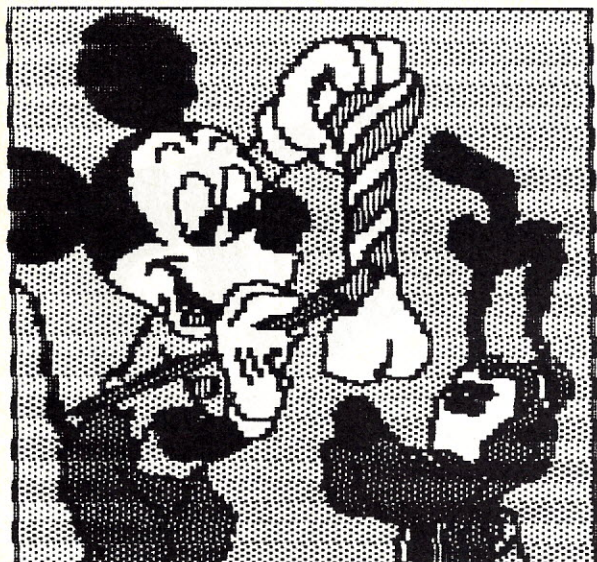
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**CIRCLE 231 ON READER SERVICE CARD**





# The Apple Graphics Tablet

*George Sternecker*



The high resolution color capabilities of the Apple computer remain largely unexploited. Most software programs do not take advantage of the attention grabbing affects of hi-res color graphics. There is no excuse for this, since the hi-res screens can be easily utilized by various graphics tablets on the maket. Here, we will focus upon the Apple Graphics Tablet.

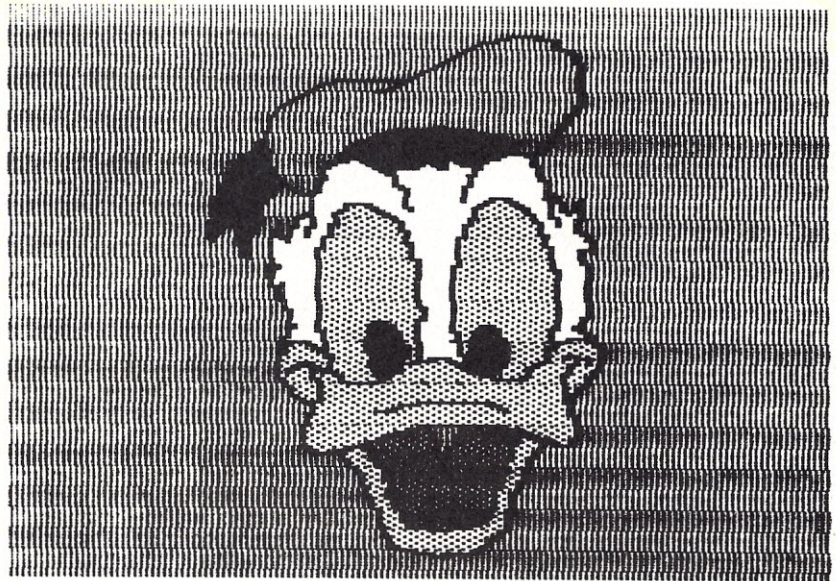
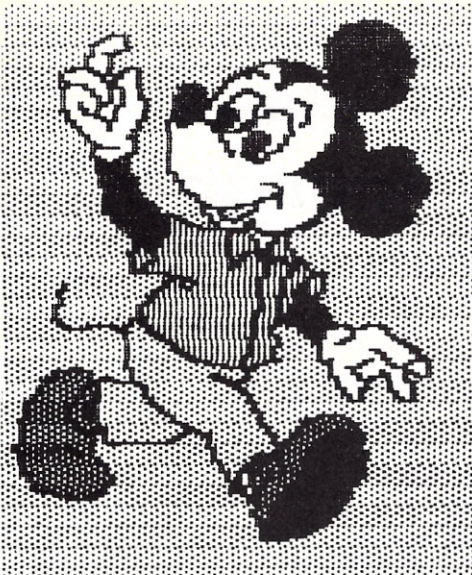
The Graphics Tablet is a magnetic bit pad which digitizes signals created by touching a magnetic pen to the tablet surface. The AGT consists of the bit pad itself, an overlay grid, magnetic pen, interface card, software, manual, and an anti-static cloth. The card goes into any peripheral slot in the computer (normally slot 5), and the bit pad and pen are both connected by wires to the interface card.

The tablet is 15"x15", and matches the Apple computer in color and styling. The AGT draws on HGR2, the second high resolution page, and uses the standard hi-res colors—black, white, blue, orange, green and violet. On the tablet itself is a mylar grid sheet which is aligned by using the calibration program. Every command on the AGT is displayed across the top of the grid sheet. Commands and program include reset, clear screen, pen color, recall and store picture, background color, area/distance, frames, boxes, straight lines, window, viewport, etc. The magnetic pen is used to draw on the screen, and also to execute any of these commands. The computer keyboard is used only to specify picture names and the disk drive numbers. One seldom has to leave the tablet surface while using the AGT.

The AGT is easy enough for anyone, including the computer novice, to use. The computer only "draws" when the pen

Graphics by Bob Bishop of Apple Computer.



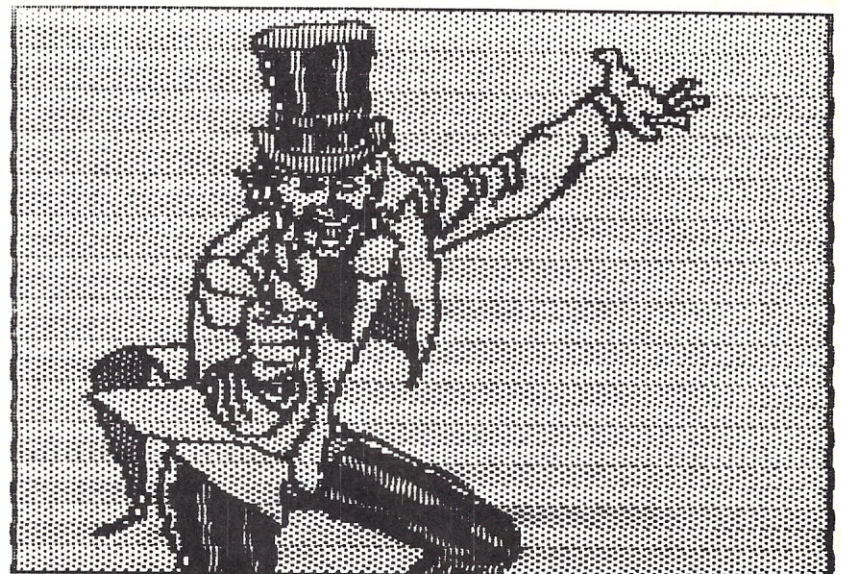


is actually touching the surface of the AGT. When the pen is close to the surface, crosshairs appear on the video screen to indicate location. Manipulating the pen is not much harder than writing with an ordinary pen, and with a little practice, you can write cursive on the video screen with panache.

Since the AGT operates on magnetic principles, static electricity is its enemy. If the user has a static charge, or if there is a bad electrical ground, strange anomalies will appear on the screen during the drawing mode. When creating graphics, always save the picture from time to time, so that if something goes wrong, all is not lost.

Two interesting commands on the AGT are "window" and "viewport". WINDOW allows you to specify an area on the grid, and have that area equal the entire video screen. That is, a square inch could be specified as the window, and if a line were drawn across that square inch, it would extend across the entire video screen. VIEWPORT allows you to isolate a section of the grid for drawing, thus freezing the remaining portion of the hi-res screen to avoid accidentally drawing there. This feature is good for editing or for fine detail work on the screen. The AGT *will not* shrink or enlarge what is already on the hi-res screen. You can also draw a rectangle, either in outline or filled, just by specifying the two end points of one diagonal. Graphics created with the AGT can be inserted into programs by going to HGR2 and executing a BLOAD PIC (picture name).

AGT operates on Applesoft basic and requires at least one disk drive. The suggested price is \$795.00, making the AGT one of the more expensive graphics tablets available. (Apple Computer Inc., 10260 Bandle Drive, Cupertino, CA 95014) □







# The Casheab Music Synthesizer

Jon Bondy

While at the West Coast Computer Faire in March 1980, I discovered the Casheab music synthesizer for the first time. Previous to this, the best music synthesizing equipment one could purchase for use on the S-100 bus was the Solid State Music SB1 board, a board with distinct limitations. Also, at that time, the only music synthesis boards for the Apple were made by ALF, and they only produced square waves. By comparison, the Casheab was extremely versatile and reasonably priced, so I purchased one of their first units, receiving it in June.

To give you an idea of how far things have come in about three years, the SSM SB1 costs about \$150 (kit) and will synthesize one voice with 32 8-bit samples per cycle of the waveform and 15 steps of amplitude control. The Casheab costs about \$1000, but provides 32 voices with sixteen waveforms each with 1024 12-bit samples per waveform and 255 levels of amplitude control. Although more expensive initially, the Casheab is far less expensive for someone who is serious about creating multi-voice music. In addition, the Casheab has FM capabilities, allowing it to do vibrato and more complex FM synthesis, as discussed below.

The standard Casheab synthesizer consists of two S-100 boards linked together by a ribbon cable: one a controller, the other one the synthesizer itself. The former contains the processor interface (S-100), timing generators, an accumulator, and the digital-to-analog section. The latter contains the frequency-generation hardware, waveform memories, and amplitude-control hardware. The synthesizer board contains a 16-MHz bit-serial signal processor which scans through the waveform memories at a rate determined by the frequency-generation hardware, to produce amplitude samples at a fixed rate through a time-multiplexing scheme. Because of the ribbon

cable, the synthesizer cannot be debugged completely without having two extender boards; however, you can debug each board individually for many problems, by removing the jumper. Due to the high frequencies used, the boards are NOT available as kits, only as assembled and tested units.

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**The Casheab has  
FM capabilities  
allowing it to do vibrato  
and more complex  
FM synthesis.**

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The synthesizer has so many control parameters that it is memory-mapped in order to avoid tying up most of the I/O ports. It uses 256 bytes of memory for control, usually allocated at 0F800H, although I use 0FF00H. Because all of the memory locations used for synthesizer control are write-only, you can run this board at the same address as a working memory board and the two will not interfere with each other; when the synthesizer is not needed, that area will look like regular memory, and when the memory is not needed, the synthesizer will be available. The synthesizer does assert the wait lines to allow for internal synchronization, which could cause the regular memory to appear to be slower with the synthesizer in the computer. Inadvertently writing to the memory when the synthesizer is running will have some fairly discordant effects, however.

Each of the 32 channels has a two-byte Frequency Control Word (FCW) which controls the rate at which the waveform for the particular channel is scanned. Frequencies can be specified in multiples of approximately 0.3 Hertz from 0 Hertz

to about 19 KHz, which provides reasonably precise control for musical purposes. Each channel also has what Casheab calls a 'weight', but which I call an Amplitude Control Word (ACW). These allow each channel to have amplitudes from zero (off) to 255. Each channel also has one byte for selecting which of the sixteen waveform tables it is to use, and a byte to indicate whether it is to FM-modulate the channel two above it or not. An FM channel, thus specified, uses its output to increase or decrease the rate at which the channel two above it is scanned, thus increasing or decreasing the pitch of that note. A channel which is used for FM is not heard at the synthesizer output; a non-FM channel is summed with all other non-FM channels and their sum is available at the sound output of the synthesizer for direct connection to a music amplifier. The synthesizer produces a single channel of audio output, combining all 32 channels into one signal.

The waveform tables are loaded by loading a special byte in the memory map with the number of the waveform table to be loaded, and then loading the table data sequentially into another special byte location in the map. One additional special memory location is used for overall scaling of the synthesizer, since the output with all 32 channels in use is significantly greater than with only one channel.

The board is strewn with wire-wrappable jumpers, to allow the user to re-configure it for either 4 or 16 waveforms, either 1024 or 2048 samples per waveform, and either 10,16, or 32 channels (yielding sampling rates of 50, 34, or 17 KHz (for frequency responses of 25, 17, or 8.5 KHz, respectively). Also, either normal or inverted phase one or phase two S-100 bus clocks can be used to trigger the board, allowing use with all 'standard' processor boards.

The first thing which impressed me about the synthesizer was the care which went into it, in terms of both the quality of the documentation and the boards themselves.



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FOURIER ANALYZER and TFA may be purchased together for a combined price of \$29.95 (Cassettes) and \$37.95 (Diskettes).

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### REGRESSION II (PARAFIT) (Available for all computers) Price: \$19.95 Cassette \$23.95 Diskette

PARAFIT is designed to handle those cases in which the parameters are imbedded (possibly nonlinearly) in the fitting function. The user simply inserts the functional form, including the parameters (A(1), A(2), etc.) as one or more BASIC statement lines. Data and results may be manipulated and plotted as with REGRESSION I. Use REGRESSION I for polynomial fitting, and PARAFIT for those complicated functions.

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## Availability

DYNACOMP software is supplied with complete documentation containing clear explanations and examples. All programs will run within 16K program memory space (ATARI requires 24K). Except where noted, programs are available on ATARI, PET, TRS-80 (Level II) and Apple (Applesoft) cassette and diskette as well as North Star single density (double density compatible) diskette. Additionally, most programs can be obtained on standard 8" CP/M floppy disks for systems running under MBASIC.

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### DFILE (North Star only)

Price: \$19.95

This handy program allows North Star users to maintain a specialized data base of all files and programs in the stack of disks which invariably accumulates. DFILE is easy to set up and use. It will organize your disks to provide efficient locating of the desired file or program.

### COMPARE (North Star only)

Price: \$12.95

COMPARE is a single disk utility software package which compares two BASIC programs and displays the file sizes of the programs in bytes, the lengths in terms of the number of statement lines, and the line numbers at which various listed differences occur. COMPARE permits the user to examine versions of his software to verify which are the more current, and to clearly identify the changes made during development.

### COMPRESS (North Star only)

Price: \$12.95

COMPRESS is a single-disk utility program which removes all unnecessary spaces and (optionally) REMARK statements from North Star BASIC programs. The source file is processed one line at a time, thus permitting very large programs to be compressed using only a small amount of computer memory. File compressions of 20-50% are commonly achieved.

### GRAFIX (TRS-80 only)

Price: \$12.95 Cassette  
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This unique program allows you to easily create graphics directly from the keyboard. You "draw" your figure using the program's extensive cursor controls. Once the figure is made, it is automatically appended to your BASIC program as a string variable. Draw a "happy face", call it H5 and then print it from your program using PRINT H5! This is a very easy way to create and save graphics.

### TIDY (TRS-80 only)

Price: \$10.95 Cassette  
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TIDY is an assembly language program which allows you to renumber the lines in your BASIC programs. TIDY also removes unnecessary spaces and REMARK statements. The result is a compacted BASIC program which uses much less memory space and executes significantly faster. Once loaded, TIDY remains in memory; you may load any number of BASIC programs without having to reload TIDY!

## SIMULATIONS and EDUCATION

### BLACK HOLE (Apple only)

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This is an exciting graphical simulation of the problems involved in closely observing a black hole with a space probe. The object is to enter and maintain, for a prescribed time, an orbit close to a small black hole. This is to be achieved without coming so near the anomaly that the tidal stress destroys the probe. Control of the craft is realistically simulated using side jets for rotation and main thrusters for acceleration. This program employs Hi-Res graphics and is educational as well as challenging.

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## Casheab, continued...

The manual is over 70 pages long, and discusses how to install board jumpers to modify the options, how to use the synthesizer hardware, the software which is provided with the boards, theory of operation of the synthesizer (and some other theory too!), references, maintenance procedures, parts lists, and a listing of a sample test program. Schematics and parts layouts are supplied separately. The boards are somewhat densely populated, but the layout is clean, and there are no last minute changes to the PC layout strewn about, as is so common with initial production units.

The software is CP/M compatible and is mostly written in Microsoft Basic, consisting of three main parts: the waveform generator, the score generator, and the Play program. Source code is provided for all software.

The waveform generator uses a Fast Fourier Transform (FFT—see "Fast Fourier Transforms on Your Home Computer", W.D. Stanley and S.J. Peterson, *Byte*, December 1978) to transform user-specified harmonic intensities into a waveform suitable for loading into the synthesizer. Attack and decay envelopes can also be specified (64 values in the range 0-255 each for attack and decay), allowing a particular waveform to be customized into a complete timbre. During my preparation for this article, Casheab suggested that I try to generate waveforms by simply adding the weighted harmonic waveforms. Compiling turned out to take 7 seconds per harmonic (running under UCSD Pascal—more on that later), so that ten harmonics took about a minute, as opposed to about 5 minutes with the FFT. The FFT program running under interpreted Basic takes about 15 minutes to compute a waveform; under compiled Basic it takes about 5 minutes. Casheab may be supplying such a program with their synthesizer by the time this article is in print. Both harmonics and timbres may be saved on disk.

The score generator accepts score notation as character strings in Basic DATA statements, and produces a HEX file as output for the Play program. The notes are represented as SANXOTMS, where 'S' represents a possible slur; 'A' the amplitude of the note (0 [off] through 9); 'N' what note (A, B, C, D, E, F, G) is to be played; 'X' whether the note is sharp, flat or natural; 'O' the octave number (0 through 6); 'T' the duration (time) of the note; and 'M' whether the note is dotted or not. Thus, a 'typical' note might be given as '3F#4Q.—', meaning that with amplitude 3, play an F# in the fourth octave as a dotted quarter note with a post-slur. The number of voices to be scored is specified, as is which channel is to be used by each voice and which voices are FM modulators. The 'notes' for each voice are then listed sequentially, with an 'X' to terminate each voice and an 'E' to terminate

the piece. Some typographical errors are flagged by the program as errors.

The Play program is the only program written in 8080 assembly language, and it ties the timbres and the scores together. It allows a score to be read into memory and timbres associated with each channel. Channel assignments can be modified, as can FM modulation flags, and attack/decay envelopes can be scaled. The piece may be started and stopped, and when stopped, the amplitude of the piece and its tempo may be varied. This software works just fine for up to about 5 voices, but for more than that, it is recommended that a real-time clock be available to the Play program in order to produce timing which is truly even. I didn't have a real-time clock and didn't want to purchase one, so I rigged up a 555 timer chip as a variable—frequency square wave oscillator controlled by a potentiometer to provide synchronization to the software via an input port. Casheab supplies two versions of their software, one for use with systems with the 8253 real-time clock and one for systems without. Since source is supplied, you could modify the code for the 8253 to work with your own real-time clock.

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***The boards are somewhat densely populated, but the layout is clean, and there are no last minute changes to the PC layout strewn about.***

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The procedure for playing a piece is somewhat involved. You first create a series of Basic DATA statements, using a text editor, to represent the music you want to play. You then run the score program to create a score file. If you need new timbres for the piece, you run the waveform program to generate them. Finally, you run the Play program to hear your music. If an error is made in the score, you must start again at the editor, then the score program, and then the Play program. Despite some inconveniences, however, the software which is delivered with the synthesizer is sufficient to allow one to encode and play any piece of up to 32 simultaneous voices.

Debugging musical pieces in this fashion is very interesting, since the scores are quite like programs, and you must listen to your 'program' to discover the mistakes which you have made. A quarter note which was written as a eighth note will result in one voice 'sliding' earlier by a eighth of a beat for the remainder of the



song, usually causing some discord, and not revealing its exact location in an obvious fashion.

The synthesizer comes complete with the above software and some musical pieces and timbres ready to play. A Bach Fugue and Prelude are included, as is "Pictures at an Exhibition" and the theme from Star Wars. Casheab also has coded a Bach Two-Part Invention, but it was not on my initial distribution disk. Timbres supplied included trumpet and clarinet, but it is relatively easy to construct new timbres from information in the literature (either *Computer Music Journal*, or text books on acoustics).

The synthesizer did not work at all when I first plugged it in, but a call to Casheab indicated that my processor (an Ithaca Audio Z-80 board) was one of those which required a modification to the clock phase and sense jumpers. After I removed the jumper from JP15 to JP17 and added a jumper from JP16 to JP17, it worked immediately and correctly. In fact, one surprising thing about this product is that it does EXACTLY what its documentation says it will; not much more, but certainly nothing less. I am used to a certain amount of 'puffing' in my sales brochures, but Casheab delivered exactly what they said, no excuses about "we're still working on it" or some such.

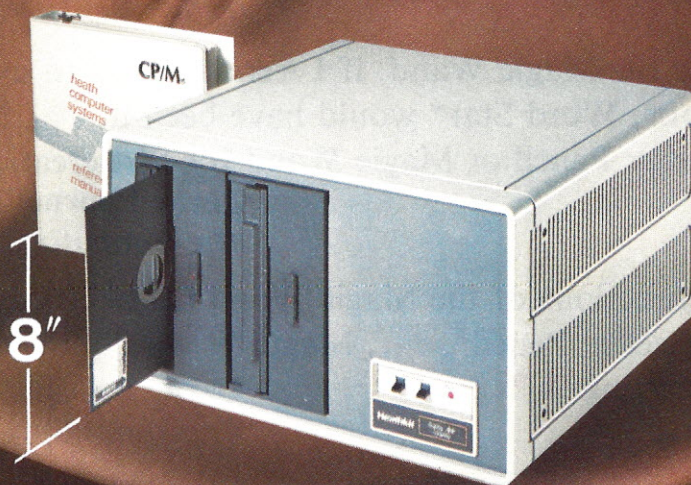
Use of the FM feature probably needs some explanation. Since an FM channel modifies the rate at which the channel two above it is scanned out, an FM channel running at low frequencies can be used to create vibrato in the modulated channel. If one places a sine waveform in channel 0 running at a low rate, say 1 Hz, then the sound coming out of channel 2 will warble slightly as its frequency changes. In order to facilitate this, I modified the syntax of the score program to allow frequencies in the range of 0.3 Hz to about 12 Hz to be specified directly instead of by using the score program note notation.

A more interesting use of the FM facility is to do 'real' FM music synthesis with it, as described in "The Synthesis of Complex Audio Spectra by Means of Frequency Modulation" by John M. Chowning (*Computer Music Journal*, Vol 1, No 2). This technique uses a frequency which is a fraction of the carrier frequency as a modulating signal; that is, if you want to hear a



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## Casheab, continued...

1000—Hz tone, you concurrently modulate it with a 500—or 250—Hz tone. This has the effect of 'spreading' the spectrum of the carrier (1000—Hz) tone so that it has many rich harmonics, even if the two waveforms being considered are simply sine waves! This means that one makes decisions about the characteristics of one's FM timbres by modifying the ratios of the carrier frequency to the modulating frequency, not by changing the harmonic content of either. Additional ways to modify the FM timbres include use of non-sine waveforms for the carrier (but not for the modulator!) and modifying the degree of FM modulation throughout the duration of the note by modifying the attack/decay envelope of the modulating tone.

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***The software which is delivered with the synthesizer is sufficient to allow one to encode and play any piece of up to 32 simultaneous voices.***

---

Other effects which can be obtained include echo and chousing. Echo can be obtained simply by repeating the notes for a voice on a second channel at a lower amplitude and with a short delay (rest) inserted before the start of the second channel. This effect can be very pleasing with organ fugues, for instance.

Chorusing is an effect which makes you think that more than one instrument is playing a voice. One problem with a digital synthesizer is its precision: twenty identical voices played at once sounds just like one loud voice. In order for a chorusing effect to work, the voices must play at slightly different frequencies, and so I modified my score program to provide three equally tempered scales, each off from the next by about 2 Hz. This allows me to have up to three channels playing the same voice but with distinct frequencies. Adding a small amount of vibrato (FM) to each channel at a different vibrato frequency allows a reasonable chorusing effect to be obtained. Unfortunately, three FM'ed channels requires six channels for a single voice, making use of these effects somewhat complex and inefficient.

One final effect which I have not yet tried is to use a large number of channels, say eight, to control the harmonics of a single note individually. Using this technique, one can control the amplitudes of each harmonic of the note throughout the

duration of the note, allowing very accurate synthesis of real musical instrument voices. Unfortunately, the Casheab could only support four voices which required control of eight harmonics each.

As stated above, I wrote the waveform program in UCSD Pascal, and in fact rewrote the entire software system in UCSD Pascal, combining it into a single program in order to be able to customize it more easily; only portions of the Play program had to remain in assembly language. The Casheab software takes advantage of single-character keystrokes for command selection, just like UCSD Pascal, but it does not take advantage of the random addressing capability of most CRT systems. My new synthesizer software does, and maintains tables of information about the synthesizer and score on the screen at all times. The cumbersome Basic DATA statement formats and line numbers were replaced with free-formats and no line numbers. Also added as a screen-oriented note editor which allows one to halt the score in the middle of play and see the notes which were then being played displayed on the screen. Those notes and notes near to them in time can then be modified and the score re-played, short-circuiting the laborious edit cycle described above. A channel-inhibit feature was also added in order to facilitate debugging multi-voiced pieces. Casheab owners who are interested in running this software can contact me at the address given at the beginning of the article.

One thing which modifying the software showed me was that the Casheab software does not BEGIN to take advantage of the flexibility which the Casheab hardware could provide. As more people purchase Casheab systems, software should develop to allow really innovative uses.

One obvious augmentation of the current Casheab system would be to allow a keyboard to be played 'through' it to simulate a sophisticated organ, or better. Casheab is aware of this, and has a general-purpose slave processor card (also S-100), which could be used as a smart keyboard-scanning card, implemented in wire-wrap form at the moment. It contains a down-loadable Z-80 system and 16K bytes of RAM, with I/O ports and some breadboarding space for placement of multiplexers and cable connectors. Software to run the synthesizer from the keyboard is working at this time, but no product using either this hardware or software has been announced yet.

The current score syntax does not allow for modifications to the tempo of the piece while it is being played; nor does it allow for 'blue' notes, that is notes which glide between normal equal tempered note frequencies. Also, the current implementation ties a hardware channel to a voice, a restriction which is really unnecessary. With the current software, it is not possible for a note to decay at the same time that another note for the same voice is attacking;

that would require one channel to be playing two notes at once. Software to provide dynamic channel allocation would allow this kind of attack/decay overlap.

In addition, the software is written to 'simulate' organ notes rather than percussive notes such as harpsichord or piano. With an organ, the note starts to attack when you hit the key, rises to a sustain level, and stays at that sustain level until the note is released, at which point it decays. With a piano note, the note attacks and then decays for the note duration, a completely different effect. Changes to the attack/decay software will be necessary fully to support percussive instruments.

There is no reason why the Casheab hardware cannot support any of these new concepts, or even more, but the software is not yet available to support them.

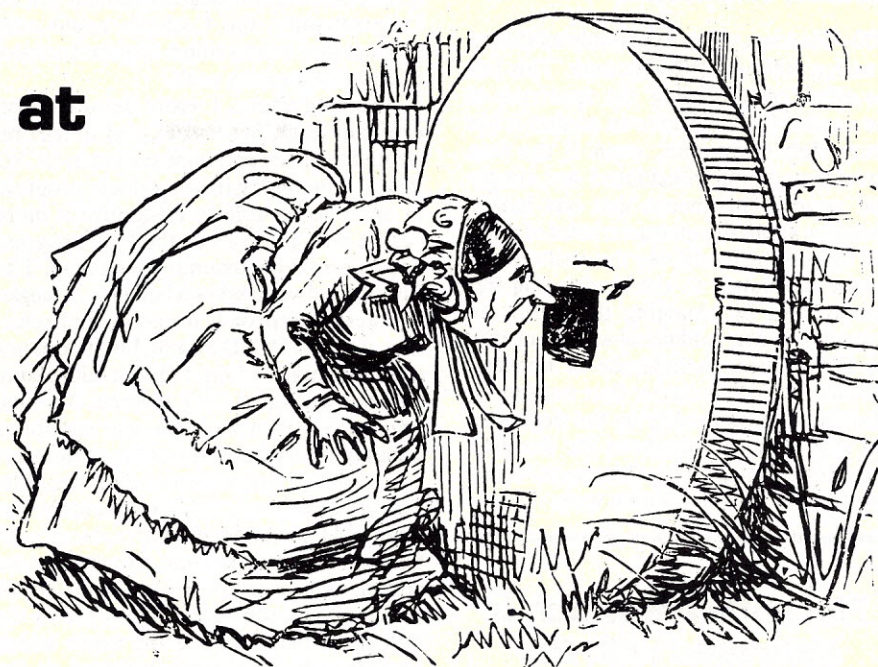
All in all, I would say that the Casheab is a high-quality piece of hardware, well thought out, well designed, and well implemented. The software is complete but somewhat Spartan, demonstrating the capabilities of the Casheab hardware, but really serving to provide a starting point from which serious computer musicians can depart. It is a unique and reasonably priced S-100 bus board which all computer musicians with S-100 bus systems should investigate. (Casheab, 5737 Avenida Sanchez, San Diego, CA 92124, (714) 277-2547.) □





# Another Look at Educational Software and Books

David Lubar



Books are easy to deal with; they've been around a long time, and you pretty much know what to expect from them. Software is another matter. The computer can be used merely to replace a book, or to take some of the load off of a teacher. Is this approach desirable? This question, and other related problems, will have to be answered sooner or later by both the software writers and the reviewers. With this unanswered problem peering over my shoulder, it's time to take a look at some educational material.

**Texas Instruments**, P.O. Box 10508, Lubock TX 79408, seems to be heading in the right direction with their *Early Reading* cartridge (\$54.95). This plug-in module, which requires the speech synthesizer, combines excellent speech capability with good programming. The child using the program has three options. First option: He can select a picture, then hear a story about the picture. Before each story, he is taught several words. The words are shown on the screen and spoken by the computer. Then the child must pick the correct word from a sentence. Once this is done, he sees and hears the story. The different parts are accompanied with graphics and animation. Finally, the story is shown again without any speech, giving the child a chance to read on his own. Second option: sentences are presented with missing words. The child must pick the correct answer from three choices. The third option presents a story. At certain parts, the child is given a choice of how to end a sentence. His selection determines the direction the story will take. At the end, questions are presented. If the child has trouble, the program branches back to the portion of the story which covers the answer. This package seems aimed at children who have some reading skills. With the aid of a parent, however, even children who haven't yet learned to read could enjoy the program.

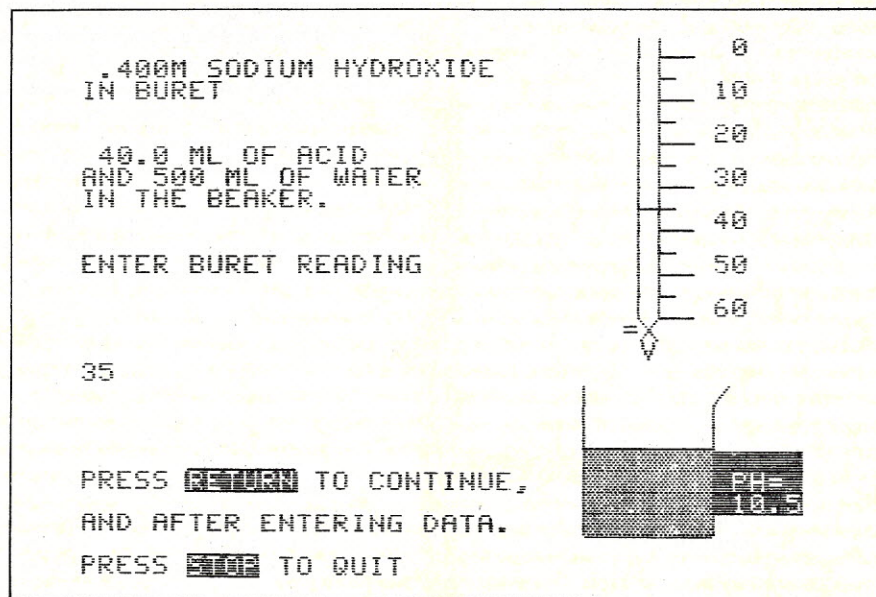
**Conduit**, P.O. Box 388, Iowa City, Iowa 52244 distributes educational software for the college level. Their full line is too wide to cover here, but a representative sample can be mentioned. In general, they combine instruction and experimentation with a leaning toward simulations. *Chemistry Laboratory Simulations* (\$40.00), a tape for the 8K PET with either ROM, allows students to practice several basic experiments. "Titration" presents a nice graphic representation of a beaker and buret. The object is to determine the molarity of an acid. The student selects the molarity of the base and the pH at which the indicator changes. Inappropriate responses result in short

lessons. The tape also contains three other programs which cover reduction-oxidation, kinetics, and the Bohr atom.

The manual that comes with the tape is well done. It describes the program and steps through a sample run. A listing of the program is included, along with a worksheet to use with each experiment.

The *Ecological Simulations* series for the Apple include programs which allow the study of the growth of two populations. This is probably best used as supplemental material, rather than a base for instruction. The most complex of the programs involves the interaction of several plants and animals on a tundra. Conduit gets high points for

A scene from Titration.





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ease of use and interaction. Each screen has a menu at the bottom. The student can move from simulation to discussion, then return to the simulation and change various parameters. A scrolling line graph shows the growth of each organism. Again, the documentation is very good.

**Data Command**, 670 W. Broadway, Bradley IL 60915, has taken the approach of combining games and instruction. The general technique is to explain the game and give some background on the area being covered. After this, the program takes the form of a quiz where each correct answer results in a score for the student in the game. *Tennis Anyone?* has units that cover plurals, prefixes, suffixes, contractions, homonyms, and base words. After each question, a graphic player volleys with a graphic paddle that represents the student. If the answer is correct, the student wins the point; if he is wrong, he loses. This isn't a bad approach, but it would be nice if the student could take more part in the actual game. He has no control over his half of the court. Still, this combination of game and test will probably hold a user's interest for longer than straight testing. The programs are available on disk for a 32K Apple with ROM Applesoft and disk and tape for the TRS-80 (32K required for disk, 16K for tape). The units are available individually for \$29.95 each, or in a set of six, covering all the subjects mentioned above, for \$170.75.

**Tycom Associates**, 68 Velma Ave., Pittsfield MA 01201, produces software for the 8K PET. Their programs are straight drill and practice. *French* (\$15.95), is well done. It presents several options. The user can see a French word for which he has to provide the English equivalent. Or he can see an English word, or the words can be mixed. Another mode presents multiple choice questions. At the end of a segment, the student is shown his percentage of correct answers. *Vocab* (\$15.95) contains two programs that present words and ask for synonyms. A nice touch is the routine which checks for spelling mistakes. If the user gives an answer that is close to the correct one, he is told that he may have made a spelling mistake and is given another chance. On wrong guesses, he is given a clue. *Algebra* (\$19.95) gives instruction in seven areas, including factoring and sets, and gives drills in each area. Unfortunately, the program crashes if you hit ENTER without first hitting a number. This sort of thing is easy to prevent and should not occur in professional software.

**Compak, Inc.**, P.O. Box 14852, Austin TX 78761, has a math package for a 32K Apple with Applesoft and TI 99/4 computers. Basically, the program presents math

problems, keeps records of student's scores, and provides help if the student has trouble. Students who do well are advanced to more difficult modules. The numbers are presented in large size on the screen. The concepts covered include addition of whole numbers, common fractions, and elementary algebra. The advanced areas contain some tutorial material, but the major function of the programs is drill and practice. On entry, the user is asked several questions, such as whether sound is desired or whether a printer is attached. The user is then asked to enter the level at which he wants to work. A number out of the range of the program will cause a crash. Answers to the math problems are entered from left to right, which seems somewhat unnatural when you are used to pencil and paper. The disks can be purchased in three fashions. The entire set, in either a concept-by-grade or grade-by-concept format costs \$495.00. Disks with all concepts for a single grade cost \$65.00, disks with one concept for all grade levels are \$50.00.

**J & S Software**, 140 Reid Ave, Port Washington NY 11050, is a producer of software for the high school and junior college level. The programs are a nice blend of question and instruction, with a well-designed branching feature. Whenever a student answers a question incorrectly, he is switched to a second program which presents more background for the questions. I only have two major criticisms of the programs. First, they won't accept "T" and "F" for "True" and "False." A minor problem, but annoying to anyone who is used to this type of entry. Also, when the student selects a unit, the computer will accept RETURN by itself as a response. Later, when it uses the input variable from this response, the null character will cause an error. Aside from these minor problems, the programs are nice. The material goes into a fair amount of depth. There are fifteen programs in both the Chemistry and Biology series. Individual programs in Chemistry cost \$19.50, a set of six is \$75.00,

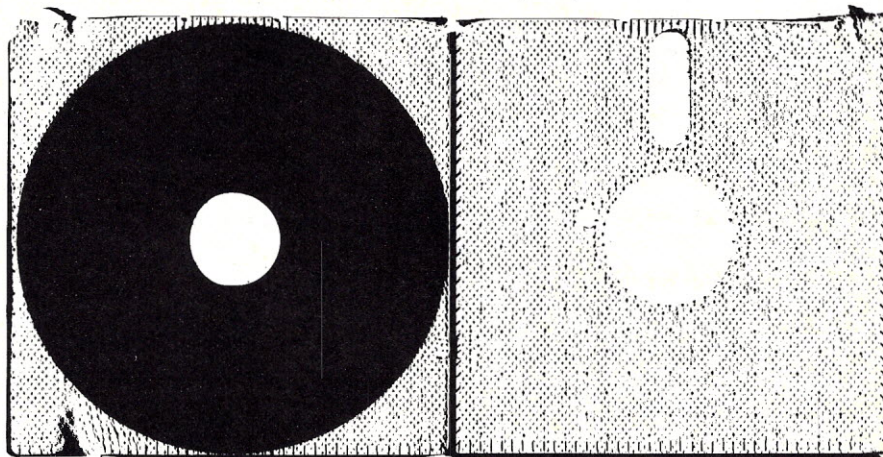
all in a set cost \$150. The Biology units are \$19.95 each, six for \$80.00, and \$160 for the whole set. The programs are available on disk or tape for a 32K Apple with Applesoft.

### Pulpware

And then there are the books. An interesting and varied assortment of educational material is on hand. *Computeronics* is a series of workbooks and manuals that deal with computers. They are well done and very reasonably priced. Some of the books cover general computer literacy, others go into a fair amount of programming instruction, showing how to work with Basic. My favorite, a book called *Sidetrips*, presents twenty-five mind teasers, along with solutions in Basic, followed by sections that cover text-type graphics and debugging. A final section gives programs and asks the student to figure out what they do. Quite a bargain for \$2.85. The highest priced item is one of the teacher's manuals. At \$10.10, even this is reasonable, especially when compared to the average price of textbooks. For more information, contact **Gifted Child Project**, c/o Seminole Blueprinting, 1212 North Monroe St., Tallahassee FL 32303.

**Computer Parts Kit** from **The Educational Computer Shoppe**, Route 3, Box 601, Cambridge MN 55008, contains a slim activities book and a lot of fantastic stuff to examine and enjoy. The \$38.50 kit includes parts from old computers, hard and floppy disks which can be examined and dissected, paper tape, and various examples of vendor literature. Craig Solomonson, who created the kit, came up with a real stroke of genius in one of the activities. A bottle of developer is included which can be applied to tape, thus showing the pattern of stored information. Once the pattern is developed, it can be lifted off with Scotch tape and saved. A teacher with a bit of background in the field could get a lot of mileage from this kit.

A dissected disk from the computer parts kit.

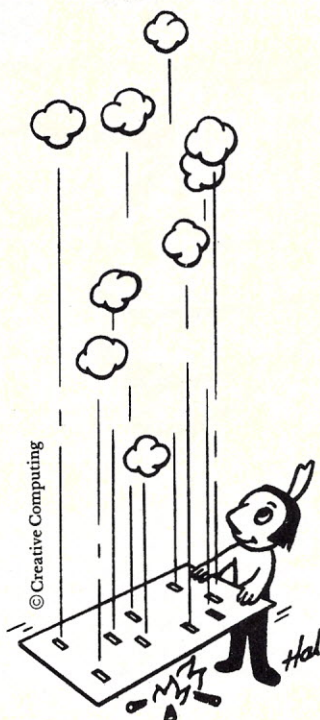




*Teaching Basic Bit by Bit* from the **Lawrence Hall of Science**, Math and Computer Education Project, University of California, Berkeley CA 94720, contains lessons and activities to help teachers present a course on Basic. While the examples are designed for Apple and PET computers, the book can be used for any system. Each section starts with a list of the activities and new concepts that will be covered, as well as prerequisites for and goals of the section. Whether it is used as the basis for a course, or just for background ideas, the book is well worth the price of \$7.50 (plus \$2.00 p&h per order).

**Resource Software International, Inc.**, 140 Sylvan Ave., Englewood Cliffs NJ 07632, markets software in the form of books. They presently have 24 packages designed for use with **CP/M** (a registered trademark of Digital Research) systems with Microsoft Basic, and are planning versions for home computers such as the Apple. Each pamphlet contains a flowchart, program listing, and teacher's guide. *Learning and Practicing with Fractions* gives word problems with multiple-choice answers. Again, we are dealing to a large extent with drill and practice. On the nice side, the program presents a pretest, and also shows the student which problems he should practice. The program listings seem to be Xeroxed, and

on some of the pages, the top line was cut off. Considering the availability of ready-to-run software, this approach does not seem to be the best way to market programs in the educational area. ☐



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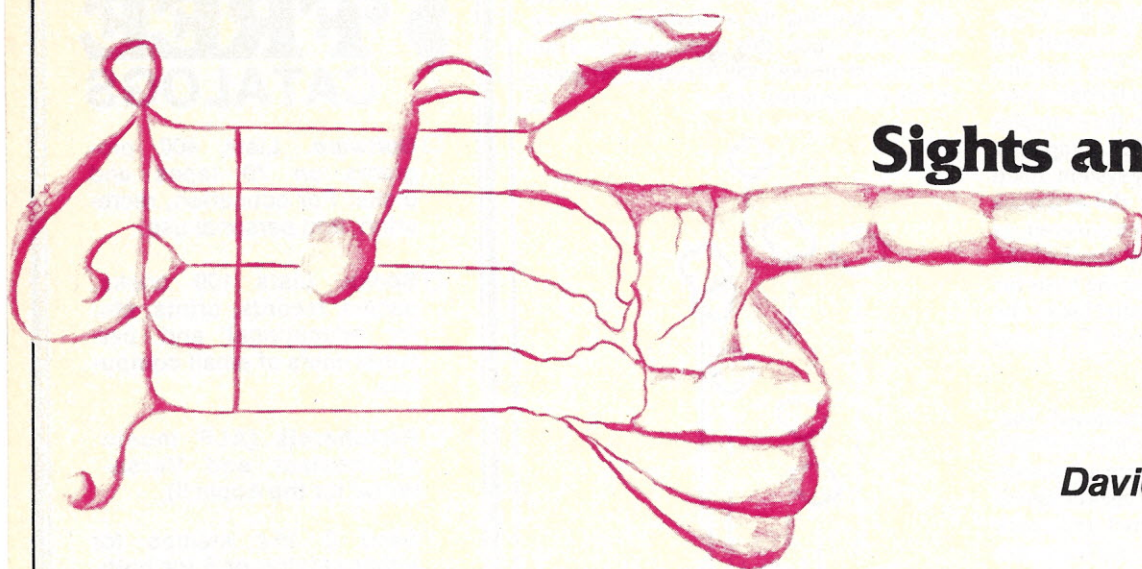
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## Sights and Sounds at PCAF

David Lubar

Above the crowd that surged through the depths of the Philadelphia Civic Center, in an inconspicuous auditorium on the first floor, great things were happening. Through hard work, and with a lot of volunteers, the Personal Computer Arts Festival turned out to be a worthwhile experience. The Festival, run by Steve Levine, Dick Moberg, and Bill Mauchly, went for two full days; Saturday was dedicated to music, Sunday to graphics. The show opened with Frank Covitz and Cliff Ashcraft, creators of the MTU music synthesis software. They demonstrated some new features of their software, using a Kim and Aim. To show the versatility of the system, they played several compositions, including Handel's *Water Music* played with an instrument that sounded like a trumpet being blown under water (wumpet?), and a classical piece done with an excellent synthesis of a harpsichord. In anticipation of the inevitable question, "Can your system only play classical music?", they also performed *Root Beer Rag* and *Foggy Mountain Breakdown*.

Next came Mike Riley from A B Computers, who demonstrated the Visible Music Monitor for the PET. This is a nice piece of software which aids in entering music for four-voice systems. It displays the notes and allows the user to define keys on the keyboard as notes to further simplify entry.

Many of you are probably familiar with the work of the next speaker, Hal Chamberlin. He's been involved in computer music for quite a while, and his newest venture is astounding. Hal is working on non-realtime music synthesis, or as he prefers to call it, computed music. The music is compiled over a long period of time; an hour or more might be required for one song. The results are saved on disks, many disks. With a sampling rate of 20 hertz,

each 8 inch disk can hold 20 seconds of music. Using two drives, and inserting disks at a rapid pace, Hal gave the audience a sample of the music the system is capable of producing. It sounded great. While this might seem like a lot of trouble to go

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**The high resolution display was reminiscent of the cartoons they used to make in the 40's and 50's.**

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through, any system that can produce these results, and is capable of 132 voices, is worth the effort.

Hal also provided some interesting insights in the field of computer music. At one time, there was a gap between the amateur and the pro. But with the advent of computed music, this gap is closing. Amateurs will soon be able to afford systems that sound as good as mega-buck synthesizers.

Many people have been looking for a music system for the TRS-80 that is comparable to available 6502 systems. Stewart Newfeld from Newtech demonstrated music systems for TRS-80 and S-100 systems. He explained that since these computers usually don't have high-resolution graphics capabilities, the entry system uses letters and numbers. The entry is done vertically, scrolling down as notes for the four voices are entered. A group of nice programming touches ease the pain of entry somewhat. The Newtech

Music Box for the TRS-80 will be reviewed here in the near future.

A valuable contribution to the festival, and the programming world in general, was made by Rebecca Mercuri of RCA, who discussed the various editors available on music systems. She feels that, at the moment, they are all lacking to some degree. Rather than just point out flaws, she came with an example; the Bach (Basic algorithms for composing harmonics) system written by Michael Keith. This displays an entire page of music in black on white, and ideally, could be used with any music board. Their demonstration was on an Apple using ALF boards. Since Ms. Mercuri has an in-depth article on music editors in these very pages, only a brief mention of her requirements for a music editor will be made here. Among other requirements, a good music editor must have audio feedback, a simple file system for blocks of music, and full screen-editing. And the system should not be designed in such a way that one careless keystroke can wipe out a whole file.

Moving into the realm of advanced synthesis, the audience was treated to a demonstration of the Fairlight CMI, courtesy of Steve Levine and Bill Mauchly. This eight-voice synthesizer has some amazing abilities. A waveform can be drawn on the CRT with a light pen and then be played. Up to 64 harmonics can be specified for any envelope, and natural sounds can be digitized for recreation or modification. The system consists of a dual-level organ keyboard, computer terminal, and dual disk drives. The price (over 30K) puts it out of range of us mortals, but serious musicians and those involved in studio work will find the Fairlight to be worth a close look.

Dropping nearer to the price range of us mortals, John Bondy demonstrated the



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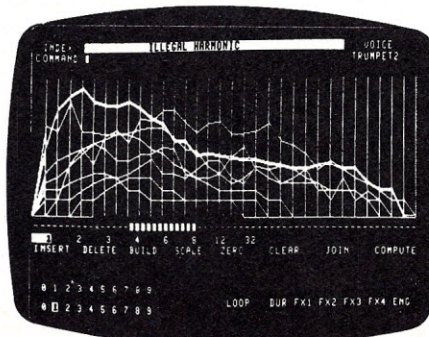
## Sights & Sounds, continued...

Casheab Digital Music Synthesizer, which is designed for the S-100. Selling for \$900 at the show (slightly higher elsewhere), the Casheab runs on Microsoft Basic and 8080 Assembly Language under CP/M. A Pascal version has also been produced. Notes are entered using alpha-numeric notation. The sound quality is decent, and the degree of user control fairly high, but to me the Casheab seems overpriced for what it delivers.

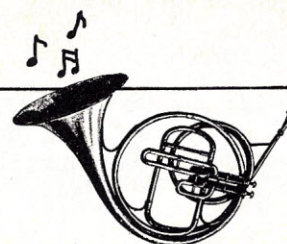
Then came demonstrations from Mountain Hardware and Syntauri Ltd. Their systems were covered last month so I won't go into detail here. The next speaker was Laurie Spiegel, a Juilliard graduate who has been involved with electronic music for about ten years. She spoke of the problems of present systems, including the limitation of standard notation to discreet steps. Demonstrating her own system, using an Apple for control and AlphaSyntauri keyboard for input, she produced some interesting and unusual effects. Ms. Spiegel is also interested in another type of synthesis, one between manufacturers of different music systems. In a conversation, she suggested that the creators of various systems should get together, combining their strong points. For example, it would be worth combining the MTU software with its great waveform capabilities and the Mountain Hardware Board with its great sound potential, forming a system that makes full use of the best side of both items. Add to this a non-discreet editor, and a keyboard such as the AlphaSyntauri, and you'll be heading in the direction of the sort of system Ms. Spiegel talked about.

Closing out the day, Kevin Doren showed the Crumar/MT1, another synthesizer aimed at a professional market, with 32 oscillators and FM synthesis capability. It was a nice, flexible system, that produced great sounds, but it's another member of the pro league that we poor amateurs can only admire from afar.

Sunday was devoted to graphics. Arch Robison opened the day with a talk on perspective graphics, demonstrating ways of creating illusions of depth. He also showed a system for storing the relative locations of any point in a 3-D drawing



A display of wave form harmonics on the Fairlight.



and determining whether any part of a line segment was on the screen.

Eric Podietz from Digital Mercury showed a beautiful real-time system for generating video art. Patterns could be drawn, then moved on the screen with a joystick, leaving trails of splendid designs as the patterns moved and rotated. Drawing to music, Mr. Podietz held the audience in rapt attention as he created art on the Advent screen.

The art of 3-D sculpture was explained by David Dameron. Using a six-slot S-100 system and a homebuilt carver, he turns blocks of wax into busts and abstracts. The carver consists of a turntable, cutters, and a stepper motor capable of steps of one mil. This machinery costs around \$900. Once a design has been entered into memory, the ratios can be changed, producing an elongated or truncated version of the sculpture. Mr. Dameron also showed some graphics done with a plotter. Not satisfied with traditional

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methods, he made innovative use of this device. Instead of moving a pen, the plotter moves a stylus across a coated piece of metal. When the metal is bathed in acid, the result is a computer-created etching.

The next treat was a movie of a flight-simulator that runs on a GE graphics system. The high resolution display was reminiscent of the cartoons they used to make in the 40's and 50's. The pilot gets a real-time view from the cockpit, and the system could also show a side view of the jet. A second movie covered the MIT Genesis system. This was one of the early animation systems, producing results similar to what can be done today on an Apple or Atari. It was interesting to watch the operator create shapes, then program the system to animate these shapes.

There was more to come, but duty called and I had to hustle down to the Creative Computing booth. Those who are interested in participating in the Personal Computer Arts Festival or in hearing of future events can write to: Computer Arts Forum, C/O PACS, Box 1954, Philadelphia PA 19105.





David Ahl, Founder and  
Publisher of Creative Computing

# creative computing

***"The beat covered by Creative Computing is one of the most important, explosive and fast-changing."—Alvin Toffler***

You might think the term "creative computing" is a contradiction. How can something as precise and logical as electronic computing possibly be creative? We think it can be. Consider the way computers are being used to create special effects in movies—image generation, coloring and computer-driven cameras and props. Or an electronic "sketchpad" for your home computer that adds animation, coloring and shading at your direction. How about a computer simulation of an invasion of killer bees with you trying to find a way of keeping them under control?

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Computers are not creative per se. But the way in which they are used can be highly creative and imaginative. Five years ago when *Creative Computing* magazine first billed itself as "The number 1 magazine of computer applications and software," we had no idea how far that idea would take us. Today, these applications are becoming so broad, so all-encompassing that the computer field will soon include virtually everything!

In light of this generality, we take "application" to mean whatever can be done with computers, *ought* to be done with computers or *might* be done with computers. That is the meat of *Creative Computing*.

Alvin Toffler, author of *Future Shock* and *The Third Wave* says, "I read *Creative Computing* not only for information about how to make the most of my own equipment but to keep an eye on how the whole field is emerging."

*Creative Computing*, the company as well as the magazine, is uniquely light-hearted but also seriously interested in all aspects of computing. Ours is the magazine of software, graphics, games and simulations for beginners and relaxing professionals. We try to present the new and important ideas of the field in a way that a 14-year old or a Cobol programmer can under-

stand them. Things like text editing, social simulations, control of household devices, animation and graphics, and communications networks.

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David Gerrold of *Star Trek* fame says, "*Creative Computing* with its unpretentious, down-to-earth lucidity encourages the computer user to have fun. *Creative Computing* makes it possible for me to learn basic programming skills and use the computer better than any other source."

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At *Creative Computing* we obtain new computer systems, peripherals, and software as soon as they are announced. We put them through their paces in our Software Development Center and also in the environment for which they are intended—home, business, laboratory, or school.

Our evaluations are unbiased and accurate. We compared word processing printers and found two losers among highly promoted makes. Conversely, we found one computer had far more than its advertised capability. Of 16 educational packages,

only seven offered solid learning value.

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# Siggraph

**Bob Wallace**



Both of us were excited to hear that this year's Siggraph conference would be near enough to visit, so we went down for a day to see what's new in computer graphics. The annual conference brings together a fascinating mixture of computer graphics enthusiasts, from personal computer users to university researchers to big computer marketing types. The most interesting things I saw, as a newcomer to Siggraph, were several new personal graphics computers and the computer film show.

Siggraph is the Association for Computing Machinery (ACM) Special Interest Group (SIG) on computer graphics. Like most of the ACM SIG's, this group publishes a newsletter and sponsors an annual conference. The name ACM always brings to my mind a group of computing machines, sort of like a labor union for robots, but it's really for people who work with computing machines, especially university people who can understand computer science papers. Siggraph was larger and more commercially oriented than I expected; it was refreshing to see an ACM event with new, real systems on display and with commercial as well as university research papers. Over 2,000 people came to see 98 exhibits, 17 technical sessions and 8 tutorials.

Many people were impressed to see IBM exhibiting a business color graphics system, feeling this area is now "blessed" and others will surely follow now that the field has been made "respectable." Digital Equipment Corporation had a new color graphics system, too. I was impressed by Hewlett-Packard's new graphics machine, with a high resolution display allowing over 4,000 colors. However, at \$40,000, it's out of my range. Much of the show repeated this story; beautiful dense color graphics with interactive three-dimensional control at prices I could never afford. But there were exceptions.

Apple exhibited their graphics tablet, showing it being used to enter pictures on the new Apple III. Having an Apple II myself, I was happy to see them involved. Intelligent Systems Corporation displayed their Compucolor line. I wonder why the Compucolor has not been more successful in the personal computer market; it outperforms the Apple in many respects, and if more software and hardware had been available for it I would have chosen it instead.

For those with bigger (but still limited) budgets whose primary interest is graphics, Cromemco's new graphics card looks like the way to go. Cromemco pioneered inexpensive color graphics with the Dazzler, back in ancient times (about 1976). Their second generation system provides various display formats, including single-color resolution of 756 by 484 points (horizontal and vertical), and

Bob Wallace, Microsoft, 10800 Northeast 8th, Suite 507, Bellevue, WA 98004.



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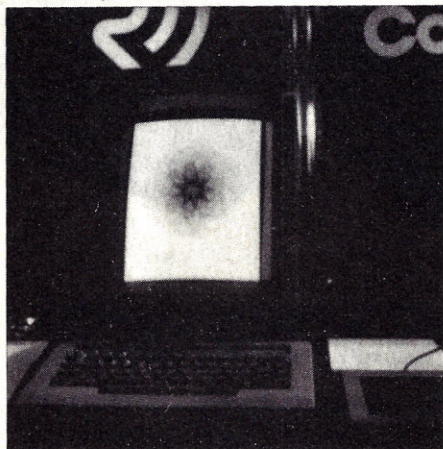
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## Siggraph, continued...

sixteen-color resolution of 378 by 242. The sixteen colors can be chosen from a palette of 4,096. I remember trying to show the Dazzler output on our local cable TV channel, and discovering we couldn't directly connect the Dazzler's video output to the cable company's equipment. However, the new Cromemco Color Graphics Interface provides both studio quality interface signals and the ability to "lock in" to an external source of synchronization, overcoming this problem. However, the output will not directly drive a color TV, even with an RF modulator, since it is RGB (red-green-blue) instead of normal video. The company does sell 13 and 19 inch RGB monitors, however.



PERQ's detailed resolution is good enough for interlocking rosettes.

The Dazzler lacked interface software, too; getting it to display a line strained the abilities of the most dedicated bit-twiddler, because figuring out where to stick a byte in memory to turn on a point in the display requires a complex mapping algorithm. The Apple requires an equally complex algorithm, but I don't need to use it since I can use PLOT and other graphics commands from Basic. The new Cromemco system provides subroutine to do things like display polygons, circles, and other shapes, and shift, scale, and rotate them.

One of the most interesting booths was a joint production by Bally, Dave Nutting Associates, and Tom DeFanti of the University of Illinois at Chicago Circle. Bally, you may recall, started to play the "home computer" game with the Arcade, which would be expandable to become a fairly powerful system; however, only the initial video-game-plus-tiny-basic version was produced. Tom DeFanti has been in the computer graphics field for years, and helped produce some of the effects for Star Wars (I believe the trench sequence was done with his system). He designed a graphics-oriented language called Grass (Graphics Symbiosis System), which has been further refined as a suitable language for people (especially artists and edu-

cators) to create programs that generate and animate graphics images.

Grass approaches Basic more than any other language, but the kinship is not close; much of the power of Grass comes from the use of macros (a macro is a sort of textual subroutine). Since all commands are macros, adding new commands is easy. Also, programs look like character strings to the user; using strings as the fundamental building block gives the system an overall unity, as well as the ability to put together a string in a program and then execute it as another program. Creating programs and data out of the same unit (as is done in Lisp and Smalltalk) opens up many doors.

In Grass, graphic images live in little boxes; one can easily define a circle, polygon, etc., in a box. (One problem I noticed was when moving around patterns, their little boxes would move around with them, which may wipe out some other pattern on the screen.) The system allows several programs to run at once (multi-tasking), all of them changing the display, which allows creating a scene in which several patterns are moving and interacting. The system is pretty fast (for a microprocessor). Although it appears to the user that programs consist of many levels of macro expansion, there is a lot of compilation and floating-point hardware running invisibly underneath that speed up the process.

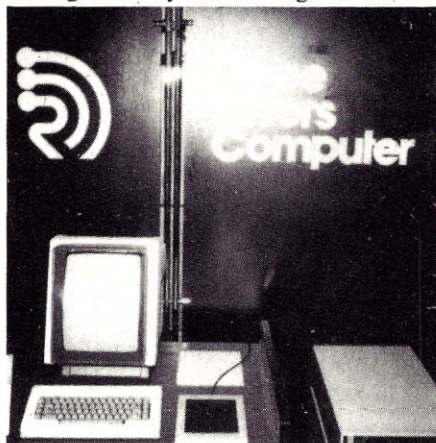
David Nutting Associates developed the UV-1 Zgrass computer using chips developed for the Bally Arcade and incorporating DeFanti's Grass language, now called Zgrass. The computer includes a Z-80, 48K of RAM, 16K of ROM, floating point processor, color monitor, music synthesizer, four (count 'em) joysticks, serial port, and assorted switches and lights. Color resolution is 320 by 204, using 4 out of 256 colors. Cost is somewhere around \$3000. It's pretty new, so don't expect it in your neighborhood computer store soon. Dave Nutting Associates is at 527 West Golf Road, Arlington Heights, Illinois 60005.

My favorite computer at the show, however, was the PERQ, by Three Rivers Computer Corporation. It looks at first like an expensive (but not out of sight) black-and-white graphics machine. But the resolution is enormous (something like 500 by 1,000), there is a text editor for a whole typed page with multiple fonts at once, it is very fast, and includes a Winchester-type hard disk. It is the most powerful system I've seen that's designed and sold as a personal computer. Actually, the selling part is still to come, as Three Rivers is just getting into production (as of July), but contrary to industry rumors they are definitely alive and on the move.

The PERQ processor directly executes Pascal P-code (at one per micro-second), which I found particularly appealing (since I am working on Micro-

soft's Pascal). Three Rivers Pascal is very powerful, having many added features like the ability to pass any length array as a parameter, as well as required extensions like strings and the ability to link together separately compiled routines. Pascal (like all current computer languages) is just too difficult for most people, but is perhaps the best language around for implementing large, powerful, interactive systems that lots of people will use.

Before leaving the exhibit area, we should mention a few more companies which make desktop graphics computers. Tektronix, because they have for years provided the graphics terminals many of us use. Chromatics, because their color terminals and systems are very nice if somewhat expensive. And Terak, for having an easy to use high resolution



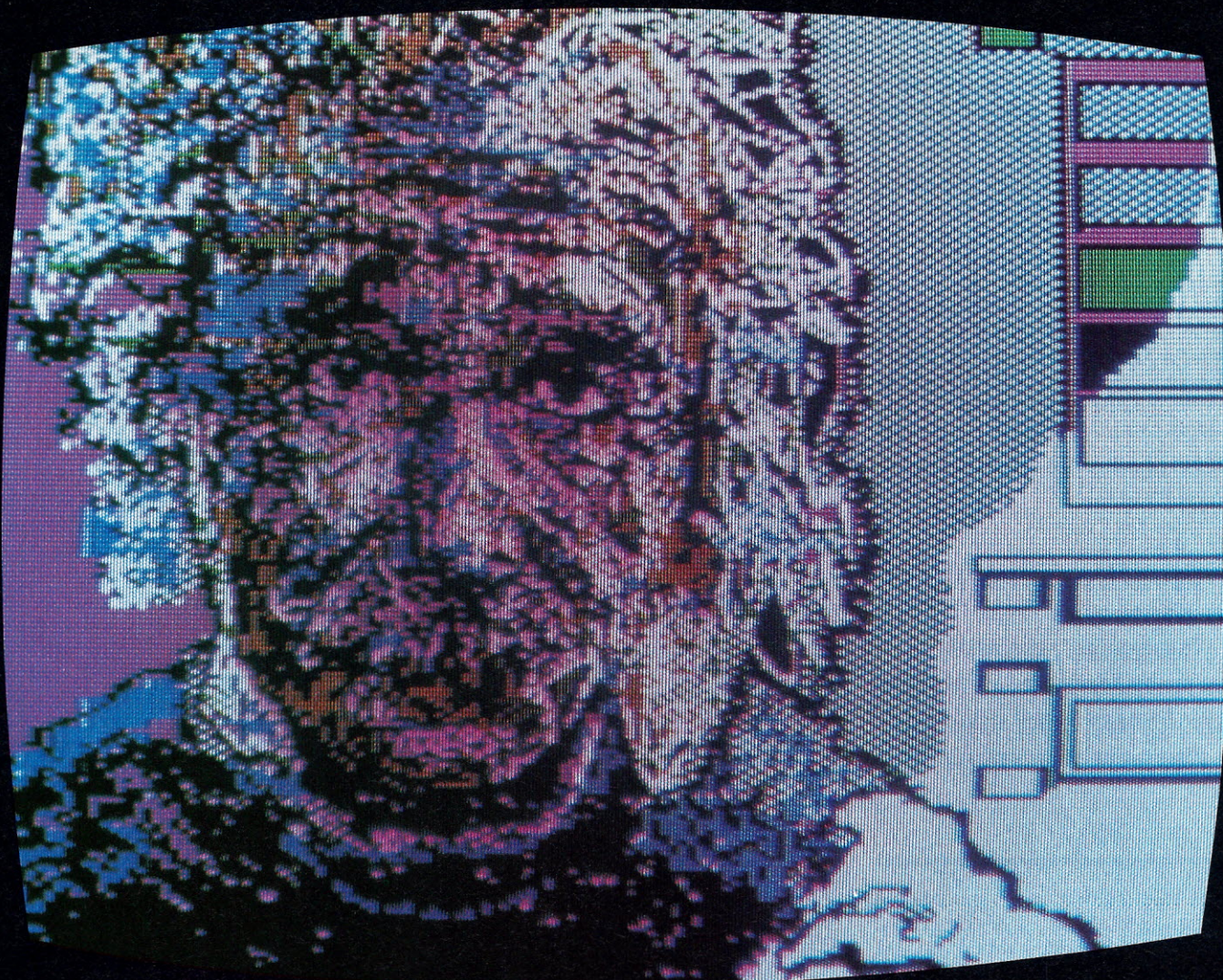
PERQ computer (right) offers keyboard, super screen, winchester and lightning Pascal for about \$20,000.

system based on the LSI-11.

We attended one seminar, "trends in high performance graphic systems". It turned out to be on VLSI (very large scale integration, hundreds of thousands of gates on a chip), and its effects on future graphics machines. One theme was pairing each memory chip with a graphics processor chip, putting a large array of these pairs together executing in parallel. Lots of multiplying and dividing must be done to change a displayed image (move it around, rotate it, scale it, etc.) especially when such niceties as curved surfaces and shading must be handled as well, and these take time. Doing them all at once speeds up the process considerably. The last paper described how university students can design their own chips and have them produced and returned without waiting a year or two.

I wanted to attend the tutorials on low cost computer graphics and user interfaces to graphics systems. The latter topic is key, since as usual, the software in this field lags several years behind the hardware. In what ways does an artist or animator organize the visual field? What's the easiest way to input a design or shape? How do factors like color and time enter in? How can images be edited and combined to form





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## Siggraph, continued...

new ones? These questions need a lot of experimentation and creativity before those who work with pictures can use computers effectively.

The film show was the high point of the conference for me. Here the newest and most intricate applications of the computer artist's craft were shown to an enthusiastic audience. The group was quick to applaud sequences with successful execution of difficult graphics tasks; smooth curved color surfaces were always well received, and the few with shadows or highlights, moving in space, practically got a standing ovation. It made no difference

***My favorite computer at the show was the PERQ, the most powerful system I've seen that's designed and sold as a personal computer.***

whether the subject was an aviation simulation, a molecule, or a commercial for a car; if the graphics were good, the oohs and ahs kept coming.

The granddaddy of computer graphics companies, Evans and Sutherland, had a film demonstrating the state-of-the-art in interactive graphics. This means real-time, color, and three-dimensional visions of (for example) complex molecules. Three-dimensional in this case includes displaying two slightly different images, one for each eye, which (with the right viewer) look like one object floating in space. Looking "inside" such an object can be done by slicing off a part in front of the viewer (using the "hither" plane), and

slicing off a part at the rear (using the "yon" plane), giving an arbitrary cross section of some depth. This is handy when studying a molecule or other object with internal structure. The amount of raw computing needed to do this in real time boggles the mind.

Rapt attention was generally reserved for those entries which were computer art for art's sake. I particularly enjoyed

"Spiral", by Tom DeFanti; it reminded me of earlier works by Whitney, but taken further technically and with great control over timing and development. Several other "serious" art works were shown. Unfortunately the programs printed for the film series were lost, and I cannot remember the names of a few others that deserve mention.

More in the entertainment field, we'll

## The Seventh Annual Conference on Computer Graphics and Interactive Techniques July 14-18, 1980, Seattle, Washington

**Andrea Lewis**

To the computer graphics inductee, the exhibits at Siggraph '80 are at first impressive, but fragmented. Image after image swirls by — auto body designs, revolving planets, graphs of functions, cartoon characters, world maps — on forbidding, "industrial looking" hardware. The imagination zooms as one wonders just how far this sophisticated technology can go. Is the day nearing when so much of man's intelligence has been deposited in micro-magnetic form to be played back in your choice of 4,095 colors and viewed

Judging from the exhibits at Siggraph '80, the range of what's available is very wide. On the high end, there are companies like Tektronix and Ramtek with high-resolution, plug-compatible intelligent terminals. An impressive high end terminal from Vector General, the 3033, mesmerizes the viewer with fast moving 3D color images of incredible resolution.

On the other end, you could see affordable graphics interface and display memory cards from Cromemco and Bally's Zgrass Graphics System. Zgrass is a user-oriented language especially designed for graphics support.

And in between, lots of swell doodads like hard copy plotters and Videoprint from Image Resource, which produces a polaroid print of your screen image.

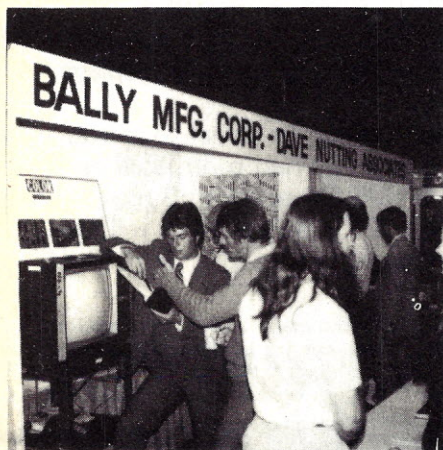
Siggraph '80 definitely has a lot to offer the "serious" attendee, although browsers were welcomed also. Siggraph (which is the Special Interest Group on Computer Graphics of the Association for Computing Machinery) knows what they're doing. Everything was coming off as planned and everything was planned well. Tutorials provided a get-involved experience for the computer literate with graphics tendencies or for those already involved in some unique aspect of the field. Since we spent only one afternoon at the show, it was difficult to gain an appreciation of the technical program. However, the session we attended (on Trends in High Performance Graphics Systems) presented top-notch people like Sproull and Fuchs, and was well paced and well attended. A fast but thorough glimpse of VLSI designs for graphics systems, it was aimed at the "machine people," but gave even the novice an idea of the research going on behind the fancy colors and rotating rockets.

Siggraph is an intelligent, special-interest show run by professionals, right down to the last pixel. Not an all-things-to-all-computer-freaks show, but one that delivered what it promised and should capture the attention of many personal computer end-users in the years to come. □

***It's easy for a writer who still can't get over the marvel of word processing to extrapolate the advantages now available to designers, planners, and analysts in any field.***

from *any* angle, that we really won't have anything left to do with ourselves except sit around in our sense-o-rama capsules? Well, maybe not, but it's easy for a writer who still can't get over the marvel of word processing to extrapolate the advantages now available to designers, planners, and analysts in any field. The ability to see all types of models, move them around, do projections, simulations and "what ifs" is sure to be a major factor in the ever-increasing rate of change in our hi-tech society.

Andrea Lewis, Microsoft, 10800 Northeast 8th, Suite 507, Bellevue, WA 98004.



Activity around the Zgrass stand.



be seeing a feature-length film done entirely with computer animation in the near future. It's called "The Works", by the New York Institute of Technology, and the previews showed an epic space opera, including ships, aliens, battles, and robots. The graphics looked good and the story interesting; I can hardly wait to see it. New York Institute of Technology had a number of other entries; must be a fascinating place to work and play.

Another place we'll all be seeing some computer graphics is the new PBS series hosted by Carl Sagan, "Cosmos". There's about forty minutes of computer graphics in the series all together, such as showing how star birth and death keeps the spiral arms of the galaxies stable, and tracing evolution by transforming drawings from a one-celled organism to homo sapiens. The graphics were not the most advanced, but were useful in explaining difficult concepts; perhaps a good example of how computer image generation is moving out of the research labs and "gee whiz" commercials and into the daily life of the television producer and educator.

On the other hand, one entry tried to be entertaining and was billed as using computer graphics, but failed to deliver on both counts. Instead, it had various singers and disco dancers plus occasional special video effects which might have some computer involvement. These moviegoers

were a rough audience; if they applauded loudly for a rotating protein molecule, they hissed and booed when subjected to straight photography. I understand that this entry will be out on video disk, so be warned.

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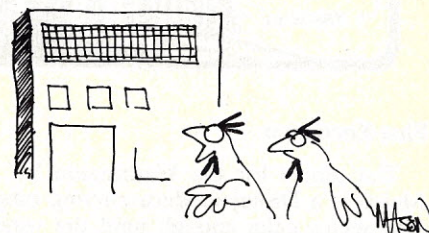
***The name ACM always brings to my mind a group of computing machines, sort of like a labor union for robots.***

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Many of the entries were sampler reels from professional computer graphics houses, but nobody minded seeing variations of the same auto commercial ad or network logos, as long as the graphics were well done. An entry from the Soviet Union showed a simulation of a six-legged robot walking over rough terrain, apparently done by plotting every frame on paper. One of the organizers showed their "City and Flight" film, a humorous way of

simulating travel by airplane and through an urban scene.

The film show was almost too successful; the hotel management threatened to shut it down because of overcrowding. The conference organizers managed to juggle 16 and 35mm projectors, plus a Light Valve video projector, with little delay between entries. One of the organizers, Rick Speer, and Bill and Ruth Kovacs, have compiled *An International Guide To Computer Animated Films*, containing descriptions and sources of over 200 films and tapes. It's available for \$5.60 from Animation Research, PO Box 2651, Seattle, WA 98111. □



*"It's nice, but I'd like to see it lay just one egg!"*

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# Computer Lawnmower



Can a computer mow your lawn? Not yet. But a flowchart can show you how to make money cutting five lawns a day. The flowchart is easy. Mowing the lawns is still hard work.

Dr. Sylvia Chorp and Marion Ball wanted a way to introduce basic computer concepts to children in grades 5 to 9 of the Philadelphia City Schools. So they identified some tasks that kids understood like mowing lawns, issuing paychecks and controlling traffic lights. They showed how computers are used in these tasks.

## Flowcharts - A basic concept

They devised flowcharts. They located scores of photos. And they found an artistic high school student to illustrate these concepts with lively full-color drawings.

They then wrote a light-hearted but informative text to tie it all together. It talked about kinds of computers, what goes on inside the machine, the language of the computer and how computers work for us.

They took the problem of averaging class grades and showed how a simple program could be written to do this job.

## Well-qualified authors

Marion Ball has written other books on computer literacy. Sylvia Chorp is the director of educational computing for Philadelphia City Schools. They pooled their talents to produce this book, *Be A Computer Literate*.

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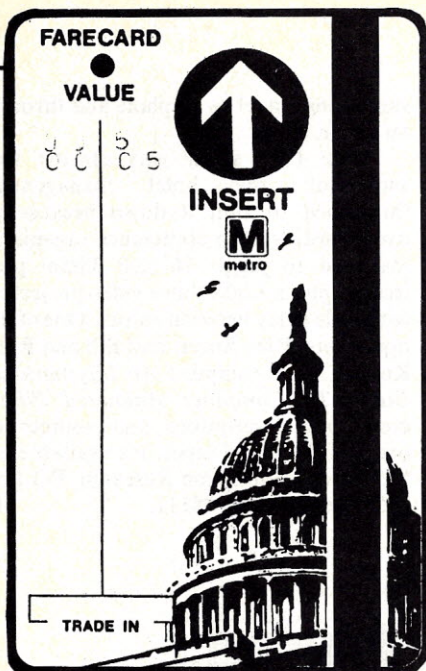
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### First Encounter

The tunnel for the Washington D.C. Metro is a Disney-modern curving tube that seems calm enough until the wind comes, pushed by the red-line subway with an ear-popping rush. They've got a system here. Tickets. Magnetic tickets. You put cash into a vending machine, push some buttons, and take a card lined with a magnetic strip. The same card lets you out at the end of the trip. For me, the end was a highway-cum-moonscape in Arlington—Pentagon City—site of the conference on Interactive Videodiscs in Education and Training.

I met two persons from DEC at breakfast on Thursday. They'd been around and knew conferences the way a pool hustler knows nine ball. We killed an hour on trade talk—rumors of a new Apple graphics package, small talk about common acquaintances, and other trivia. Then, armed with a stack of blank tapes and other paraphernalia, I went in to catch the first talk.

The conference was a sedate affair, with a mostly-male crowd of 150 from a variety of fields. There was a group from ETS, men from MECC, front men from Sony, DiscoVision, and other manufacturers of video equipment, and members of the army. My last remnants of radical sixties anti-uniform paranoia were destroyed by the great work the Army is doing. More on that later.

Dr. Malcolm Davis, from the U.S. Dept. of Education gave the first address, "Impact of Videodisc Technology on Public Education." Among the points he made was the crucial idea that you can't put the same old material on video discs and think it's going to work. Revamped versions of old films just won't make it.

It soon became apparent that there is a good technology out there which just needs

the right uses. But there are problems with this technology. Throughout the talks, the speakers honestly dealt with some of the problems and limitations. The discs, by themselves, could turn into nothing more than glorified movies. It was only when a computer got into the act that the magic happened. But some of the big miracles had nothing to do with discs. More on that too at a later time.

Among the issues covered during this contagious spate of honesty were problems dealing with a lack of standardization, with costs, and with technical difficulties. The industry is new, and the means of getting information onto a disc vary in large and small ways. There are capacitance methods, such as the one used by RCA. There are

transmission techniques where the laser beam is read after passing through the disc, and reflection techniques using mirror-like discs.

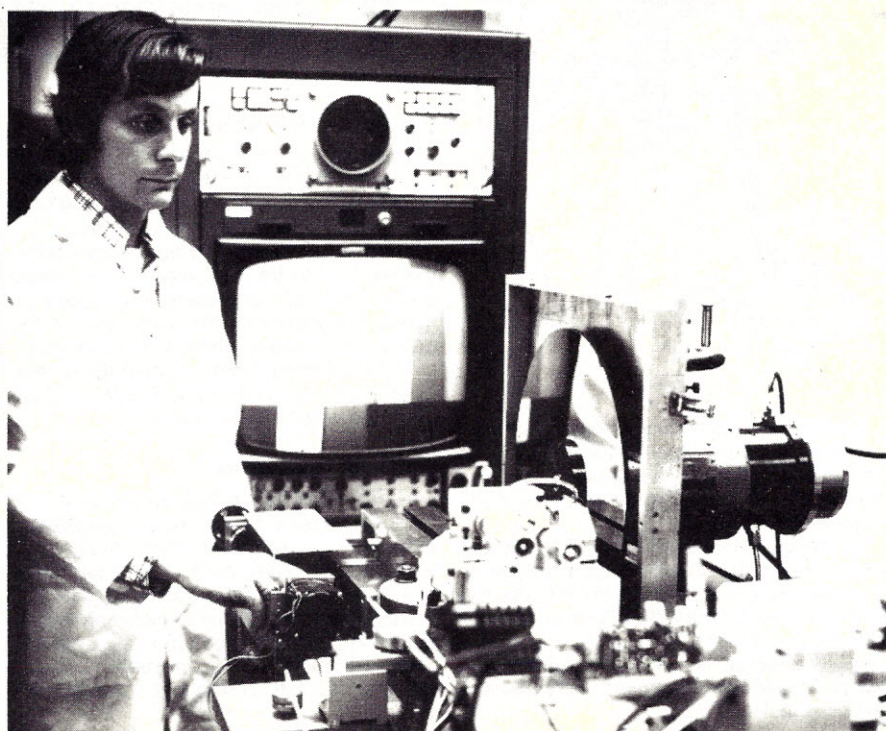
Dr. Davis presented some hurdles facing videodiscs on their way into the classroom. School budgets were low, and teachers were reluctant to deal with anything that was spoken of in terms of replacement.

Throughout the day, the click of recorders running out popped through the room. What was needed, I realized, was a recorder that stayed off until something important was said, then recorded everything it missed.

The next speaker, Dr. Alfred Bork, added some more common sense to the air of the day. He believes the major systems will be

# DAWN OF THE DISC

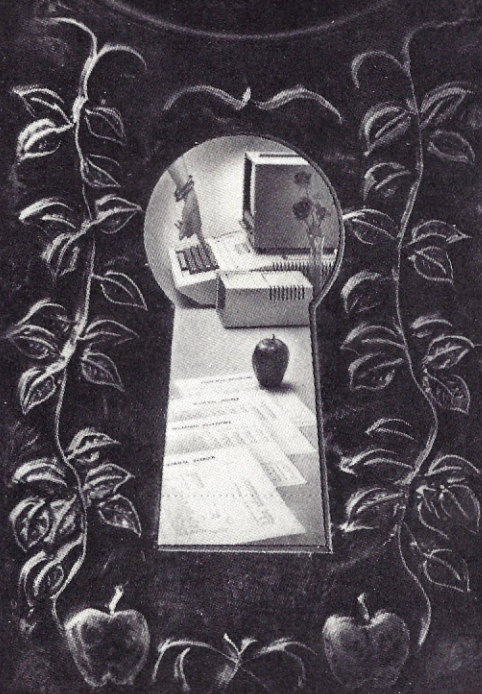
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A phase in the mastering process.



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## Disc, continued...

of the stand-alone sort, and these systems will commonly appear in public places. He pointed out that you can develop an interactive video system in several ways; start with a program and add the video, start with video and add the program, or start from scratch. The third way seems best suited to producing usable material. To tantalize us a bit, the Dr. also spoke of brain-wave input and the problems thereof.

John Volk slapped even more perspective on the issue by showing the capabilities and limitations of videodiscs. A disc that can store 54,000 frames, where each frame is equivalent to the image on a TV screen, holds a lot of data. But if that data is something that can be stored in a more compact form, the videodisc must cede its position to the hard disk. After all, you don't have to store an entire screen to store the lines of text that are on the screen. But hard disks drop back to second place when picture storage is needed.

Lunch was the next item, with a buffet available. I skipped it to investigate the pinball machines on the mezzanine. Sad to report, Arlington has followed the rest of the country in going to the outrageous quarter-a-game three-ball-per-game system. Is nothing sacred? After lunch I managed to speak with some of the others at the conference. Dr. Allen Glenn from the University of Minnesota, and from the Minnesota Educational Computer consortium filled me in on the work MECC is doing. They are presently working on integrating computers and videodiscs, producing educational programs in the field of economics. Dr. David Yens from the Mount Sinai School of Medicine also had some interesting comments. He explained that the interest in videodiscs was nothing new. The same thing had happened with educational radio (must have been before my time), educational television, and computers. People would predict major changes, others would worry about these changes, and nothing super-drastring would happen. Dr. Yens plays a major role in later less-academic portions of this story.

After lunch, Charles Frye took the stand. He is the creator of a CAI language known as Planit (see *Creative Computing*, vol. 1, no. 1). Dr. Frye believes that a common strategy for those doing videodisc programs will be to work the programs around existing pictures. Programming is called "authoring" those in the field. I will refrain from commenting on this coinage. Back to the issue, a series of lesson where only thirty seconds was spent on each picture would mean a disc could hold 900 hours of visuals. There will be plenty of room on discs, and most will hold more material than any one instructor can use. That is good since the discs are rather expensive to create. At the moment, creation of a master costs



Testing the finished product.

around \$10,000.

Dr. Frye also spoke of the need to develop transportable software. Standardized techniques and languages are needed so any disc will run on any machine.

Mike Doyle from Thompson CFS came up next and told us all about his product. Thompson is working with Xerox on read-write discs and with 3M on mastering and replication techniques. Their disc uses the transmission method. The disc, made of polyvinyl chloride, is transparent. The laser zaps through it, reading either surface.

Dr. William Ford spoke about picture data-base systems, stressing the problem of assembling all the material and putting it on disc. He sees a need for a system that would tell how much room is left on a disc and where that room is. He envisions the creation of timesharing systems that will cost around 30K and allow instant access to over 100 discs.

### Great Disc-coveries

So far, everything seemed interesting, but most of it also seemed to be in the planning stage. Bringing the audience back to the present, Dr. John C. Ittleleson, from

DesignWare, Inc., delivered a talk with the unpromising title, "Mentor Systems for Videodisc Authoring." The talk and demonstration turned out to be outstanding. The Mentor system uses videotape. While many systems put program information on the audio track, Mentor uses video frames. Seventeen seconds of tape can hold as much data as twenty Apple disks. This data is saved in a redundant manner to assure accurate storage and retrieval. The Mentor system uses videotape and computers to deliver lessons. But this is just the beginning. Or, more properly, the end. The lessons have to get on the tape. That could be one excruciating process. But the authoring system (there's that word again) makes it all a snap. The author can design a lesson with infinite (well, finite but great) branches allowing for questions and answers and all the other trappings of good CAI. Once the desired sequences are specified, the Mentor system creates the program and puts it on the tape along with the meat of the lesson. Dr. Ittleleson mentioned that the system would also work with videodiscs, but they wanted to produce





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## Disc, continued...

a system usable with available technology. Mentor was very impressive, and I expect to see a lot more in the way of innovation from Dr. Ittleson and DesignWare.

The day was capped off with another winner. Dr. Steve Levin demonstrated videodisc-based surrogate travel (you can get there from here). It was great. What they do is go somewhere and film everything. Then it's all put on a disc. Next, someone sits in front of two CRT's and uses a joystick to move around on a map of the place. Once an area has been selected, he switches to the other screen and takes a walk through the scene. The joystick controls speed and direction of travel. The angle and height of viewpoint can be changed. Great. Imagine the adventure games you could have with this system. (Are you listening, Scott Adams?) And, wonder of wonders, there are even practical uses. Dr. Levin showed an example of a disc made of San Francisco Bay. The pictures were taken from the same height as the vantage point of a ship's pilot. The disc could be used for training. A budding young pilot could get to know the waters with no risk of sending himself and a million dollars worth of ship to the briny deep.

Very impressive. And the best part is the time factor. The shooting of the harbor only took seven hours. They also did a nuclear reactor in three hours. Obviously, they've got the system down cold. This is a great use of videodiscs, making full use of the abilities of the medium instead of merely transporting old ideas to a new form. The system is presently running on a Z-80, but they are reconfiguring it to run on an Apple.

That wrapped up the business end of the day. Everyone moved to another room for a cash-bar, pretzels-and-chips reception. I mingled for a while, spending most of my time answering questions about Sesame Place, which many people at the conference wanted to know about.

There was little talk concerning videodiscs. Everyone probably needed a break from the subject. No hot scoops, no industrial secrets. Oh well.

### Food and Peril

After the reception, Dr. Yens and I decided to go in search of nourishment. We had an interesting ride in search of a Vietnamese restaurant, getting lost on the way and ending up at the Pentagon. (It really does have five sides.) The restaurant was closed. On the way to a second restaurant (of the open variety), Dr. Yens told me some of the work he had been doing with computers, and some of the ideas he had for future projects. While this was all interesting, I missed a lot of what was happening while alternating between spates of fear and admiration for the Doctor's driving. He handled his Plymouth

like he'd been born with the wheel in his hands. Sort of the same beauty that can be found in a good horror movie.

At the restaurant, Dr. Yens went into more detail about the similarity between educational videodiscs and educational radio. He seemed to represent the popular attitude at the show: these things are interesting and powerful, but what can they do and what difference will they make in education? Like most of the attendees, however, he seemed to be impressed by some of the applications. After dinner, we went to the piano lounge at the hotel, where I listened to an excellent singer and drank some decent concoctions from the depths of a blender while the good Doctor wore out several partners in a frenzy of disco fever.

Back to the room, I began drafting some ideas for this article. As should be obvious, the two things that impressed me the most were the Mentor System and the surrogate travel. One ran on tape but could be adapted

## ***This is a great use of videodiscs, making full use of the abilities of the medium instead of merely transporting old ideas to a new form.***

to disk; the other required a disc. Videodiscs weren't going to shake the earth or change the face of education, but they would have their uses, they would allow some new approaches to education. Like the little magnetic strip on the subway card, like the cassettes in the tape recorders, videodiscs were just a way of storing and retrieving information. A way that served well in certain situations, but should not be used in others.

### Flip Side

This is getting a bit long, so I'll just go into the highlights of the second day. Mark Heyer from Sony demonstrated the disc his company produces; it is stamped, one sided, and compatible with the DVA format. The player employs a moving lens and steady spindle instead of the usual moving spindle approach. The player can store 500 commands.

Dr. James Baker from the Army (ours), took the podium and explained how the military was drowning under a paper deluge. There were tons of field manuals and other books being used, and the situation was reaching a critical point. They see videodiscs as the answer. In cooperation with Charles Frye, they are developing a version of Planit that will run on small computers. The plan is for this language to be trans-

portable. They want it to run on any small computer. A neat trick, if it is possible. The goal is to develop a sturdy field unit consisting of computer, videodisc player, and screen; perhaps something the size of a portable stereo. This could be carried on maneuvers. The discs would contain a variety of information; pictures, programs, practice games, and a dual audio channel. Perhaps the Army and the paper flood can do for the videodisc what NASA and the space race did for the computer.

It was getting late and my train would be leaving soon, but the Army had me hooked, and I stayed around to hear Colonel John Goetz. He explained that the videodisc had to be more than just an electronic page-turner. One possible use was in electronic training. With the aid of a light pen, trainees could attempt to patch circuits that were displayed on the screen. The disc would display different parts of the circuit, as well as meters and whatever. The Army, by the way, is planning to use Apples for some of these projects.

It was time for me to head back through the labyrinth, armed with another magnetic fare card and a new respect for the potential of the videodisc—a respect tempered with the realization that, amidst the few innovative and appropriate uses, the discs will probably be used also in all the wrong ways for all the wrong applications. But they should survive this treatment.

Yeah, they use magnetic strips on little cards beneath the streets of Washington. And the card also makes a great book mark. But I wouldn't try to store a program on that little strip; it just isn't designed for that. □

For further information about Videodiscs and computers, see *Creative Computing*, vol. 2, no. 2. An article by Alfred Bork discusses the role of an "intelligent" stand-alone videodisc system in education while a short piece by Arthur Luehrmann talks about a \$2.98 computer library. After all, one videodisc can store  $10^{10}$  bits of information. Other pieces discuss the technology of videodiscs, future technology and artificial intelligence. The issue is available for \$2.00 postpaid.

*Scientific American*, Vol 243, Number 2, pp. 138-148, contains a good article on disk technology, covering both magnetic and optical techniques.

The proceedings from the conference on Interactive Videodiscs in Education and Training will be available in the near future. For information, contact the society for Applied Learning Technology, 50 Culpeper St., Warrenton, VA 22186.

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# A Visit to



## Betsy Staples

Sesame Place, billed as "an innovative play park for children three to thirteen offering a free-flowing combination of outdoor physical activities and challenging educational games," opened to the public on July 30, 1980, only three months after its scheduled May 1 opening.

On July 29, we gathered up Kristin, a nine-year old niece, and Gordy, a three-year old nephew, and set off for the special preview opening of Sesame Place. It was pouring rain when we left, but we decided to take our chances.

By the time we arrived in Lower Bucks County, Pennsylvania an hour later, the sky had cleared and the day was hot and steamy. We were met at the gate by young staff members uniformed in the yellow, red and green theme colors of the park. Each of us received a commemorative packet containing a large button, a patch and a sheet of stamps all sporting the park's Big Bird logo.

And not far from the entrance was the Bird himself singing and cavorting above the crows on (could it really have been?) a cat walk. The children found him amusing for a while, but soon wanted to try some of the activities.

Kristin's first choice was a climb through a web of cargo nets strung four stories above the park. Gordy, was game, but his little feet slipped too easily through the mesh, so he settled for a few trips down a giant orange and purple plastic slide.

In the Sesame Street Construction Company area, Gordy required a bit of help from another little boy to lift the lightweight, interlocking polyurethane blocks into position to create the foundation of what he claimed was to become a garage. Both children found the Monster Maze, a forest of six-foot high punching bags, a total bore. Apparently others did, too, since it was the only functioning attraction in the park completely devoid of activity.

Emphasis throughout the park is on participation, and participation is made



*An array of cargo nets, strung four-stories above the ground, is just one of several ways of circumnavigating Sesame Place. Slat bridges, ramps and the ground are among the other routes in Langhorne, Pa. throughout the park.*

easier for younger children by helpful high school and college age staff members — both male and female — who are alert to trepidation and happy to provide support when needed.

Unfortunately, many of the 40 "outdoor play elements" were out of commission, awaiting, we supposed, final adjustments to make them playable.

The children wanted to try the Count's Ballroom, a pool of 80,000 green plastic balls in which to dive, swim or just disappear. However, the weather had taken its toll, and the 80,000 green plastic balls had been joined by many gallons of rainwater. We watched as staff members tried a pump (water not deep enough) and finally a vacuum cleaner to remove it. Seeing the antics of the young vacuumers whetted everyone's appetite for a romp with the Count.

Gordy was in the first group invited in. (Children are separated by size into two groups which alternate periods of play.) He slid into the pool and stood stock still as the sea of green balls closed in over his head. An alert helper rescued him, but he was not eager to try again. Kristin was apparently just the right size, because she had a ball.

After trying all the outdoor attrac-

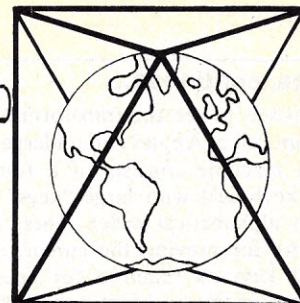
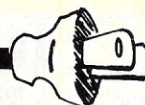
tions, we went in to the Computer Gallery. As regular readers of *Creative Computing* know, we were involved in the early stages of the development of this area, but we



*Gordy's sneakers bring his trip down a giant purple and orange slide to a temporary halt.*



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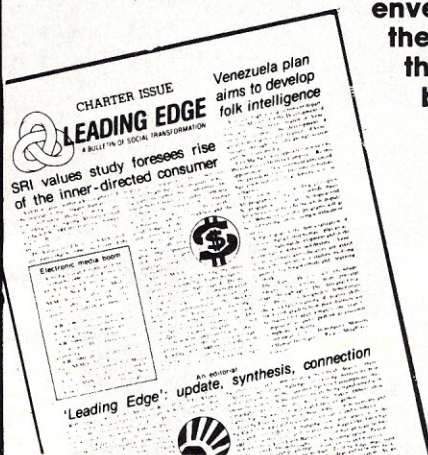
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HOURS PER WEEK SPENT WATCHING TV \_\_\_\_\_  
HOURS OF DAY THE TV IS ON \_\_\_\_\_  
# OF THE PEOPLE WHO WATCH \_\_\_\_\_  
# OF SETS IN HOUSE \_\_\_\_\_

NEW WORLD ACTIVITIES

MANY PEOPLE ARE PARTICIPATING IN A CULTURAL REVOLUTION THROUGHOUT THE PLANET. NEW IDEAS ARE TRANSFORMING OUR CONSCIOUSNESS AND OUR ENVIRONMENT INTO A GLOBAL COMMUNITY.  
WHAT ARE YOU DOING LOCALLY TO BRING ABOUT THESE CHANGES?  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

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Send this form, \$1 and a self-stamped, envelope to receive the current issue of this outstanding bulletin.



PLEASE LIST NAMES AND PHONE NUMBERS OF PEOPLE IN YOUR COMMUNITY WHO ARE MAKING CHANGES AND WOULD LIKE TO SHARE THEIR CONTRIBUTIONS THROUGH TV:

NAME (AREA CODE) NUMBER

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
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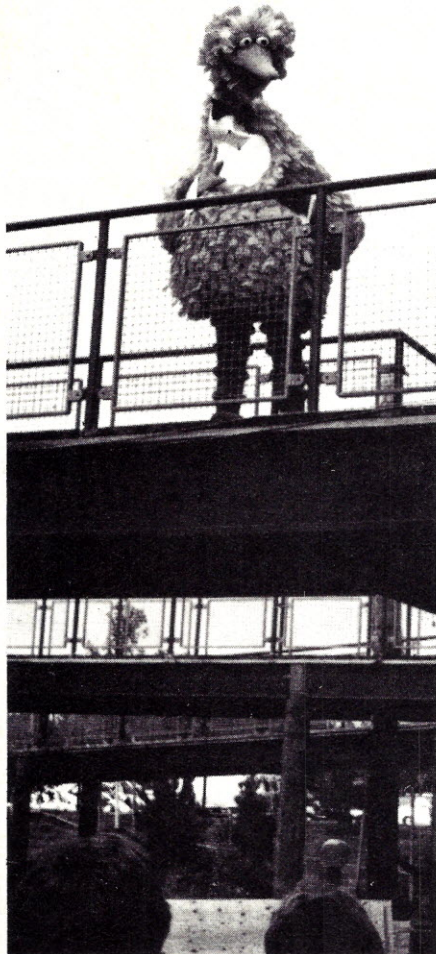


## Sesame, continued...

were surprised to see the transformation that a room full of Apples had undergone.

Each machine consists of a touch-sensitive keyboard with large "keys" arranged in alphabetical order. There are also arrows for moving the cursor, and additional keys as required for special games. Conspicuously absent is the "reset" key.

The color monitor is housed in a large, brightly colored metal box which also accommodates the "coin-op" mechanism. Tokens are required to change the pro-



*Big Bird serenades his fans.*

gram from attract to play mode. They are on sale at three for a dollar.

Players sit on movable, carpet-covered boxes, and the designers seem to have done a good job of child-proofing the machines and their surroundings.

All the Apples are controlled by a Nestar system temporarily (we hope) housed in the staff men's room.

Less than half of the advertised "70 specially created electronic games" were available in the Gallery when we were there. Some of the more clever ones included Reflect, in which the player tries to bounce a beam of light off a mirror at exactly the right angle to illuminate an object, and a non-violent version of Hang-



*Throngs of adults mob the computer center at Sesame Place to escape an afternoon thunderstorm. tokens were free at the press preview but normally are three for \$1. Each token provides 4 minutes of play.*

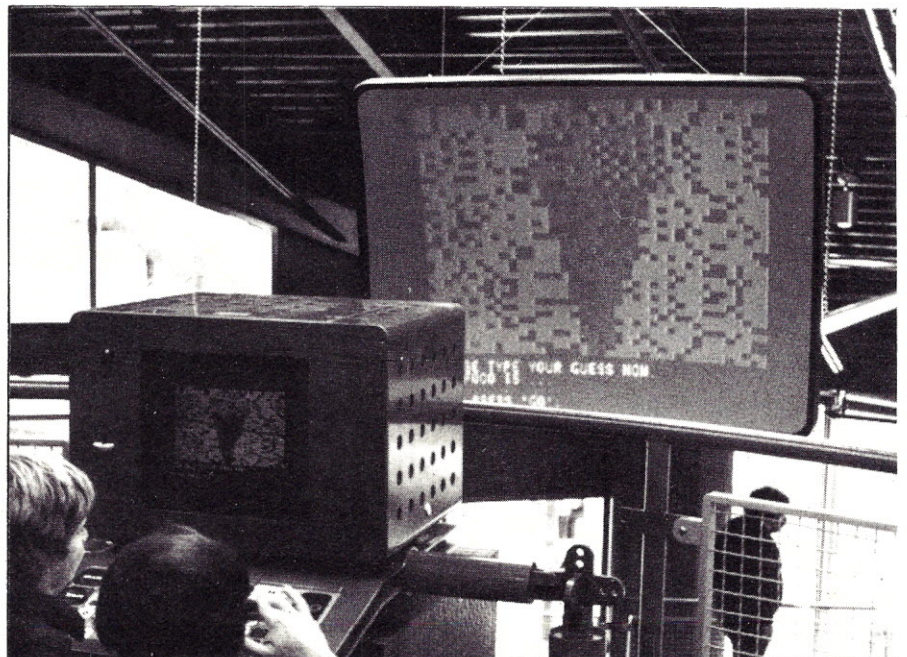
man with amusing graphics. In Mup-O-Matic a picture is created on the screen as random pixels are filled in. The child presses a button to stop the picture and type in his or her guess as to its identity. This was fun for a few times, but grew tiresome in its myriad variations — Muppets, fruit, animals, sports equipment, etc.

Kristin was able to enjoy most of the games, but since almost all of them require that the child be able to read, Gordy was not impressed.

At the Sesame Food Factory, we were treated to a cheese and sprout sandwich on

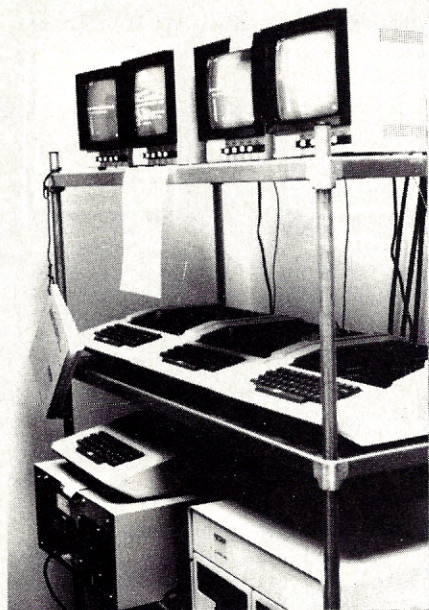
a large soft pretzel, raw vegetables, a plum and a peanutbutter brownie in a box lunch followed by ice cream cones. The menu includes some unusual and tempting items, all of which promise "a minimum of preservatives and additives and appreciably lower amounts of sugar and salt."

What was our overall impression of Sesame Place? It is certainly a colorful, comfortable, interesting place to visit — particularly for children. There is much to be learned and the children we took had a grand time, even though Gordy, at the bottom of the suggested age range, was



*A giant screen repeats the Mup-O-Matic picture on the monitor. "Please type in your guess now."*





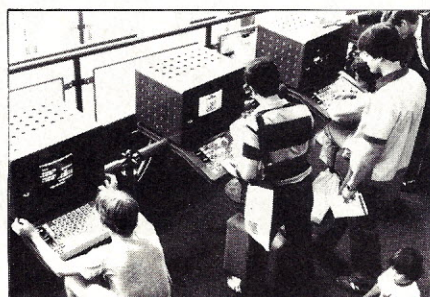
*The brains of the outfit: this Nestar system controls all the Apples in the Computer Gallery.*

barely old enough to enjoy some of the activities and just plain too little to use others.

Our main disappointment was in the fact that there is virtually nothing for



*No, those are not Lilliputians wallowing in fresh peas; that's Kristin in the foreground enjoying a romp in The Count's Ballroom.*



*Players sit on carpeted cubes and type on specially designed keyboards to try the games in the Computer Gallery.*

adults (anyone over 5'2" or thirteen years of age) to do. Of course, it's fun to watch the children having a good time, and a few of the computer games are suitable for grown-ups, but other than that parents, teachers, older siblings, aunts and uncles will find that their most important role at Sesame Place is keeping track of socks and sneakers while the little ones bounce, build, crawl, climb and swing their way through the park.

Sesame Place is intended to appeal to residents who live in the surrounding geographical area rather than to tourists, and is said to be designed for many visits of two to three hours each. This is a nice concept, but we doubt that many parents will be willing to pay the \$3.95 admission fee for themselves on a regular basis. This park seems to be the perfect example of a place where an adult accompanied by a child should be entitled to a substantially reduced rate. □



# new friends for your child...

## Katie and the Computer

Fred D'Ignazio and Stan Gilliam have created a delightful picture book adventure that explains how a computer works to a child. Katie "falls" into the imaginary land of Cybernia inside her Daddy's home computer. Her journey parallels the path of a simple command through the stages of processing in a computer, thus explaining the fundamentals of computer operation to 4 to 10 year olds. Supplemental explanatory information on computers, bytes, hardware and software is contained in the front and back end papers.

Thrill with your children as they join the Flower Bytes on a bobsled race to the CPU. Share Katie's excitement as she encounters the multi-legged and mean Bug who lassoes her plane and spins her into a terrifying loop. Laugh at the madcap race she takes with the Flower Painters by bus to the CRT.

"Towards a higher goal, the book teaches the rewards of absorbing the carefully-written word and anticipating the next page with enthusiasm..."

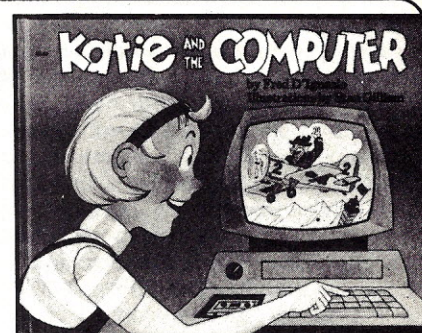
**The Leader**

"Children might not suspect at first there's a method to all this madness—a lesson about how computers work. It does its job well."

**The Charlotte Observer**

"...the book is both entertaining and educational."

**Infosystems**



The book has received wide acclaim and rave reviews. A few comments are:

"Lively cartoon characters guide readers through the inner chamber of the computer."

**School Library Journal**

"...an imaginative and beautifully conceived children's story that introduces two characters—the Colonel and the Bug—who already seem to have been classic children's story book characters for generations."

**The Chapel Hill Newspaper**

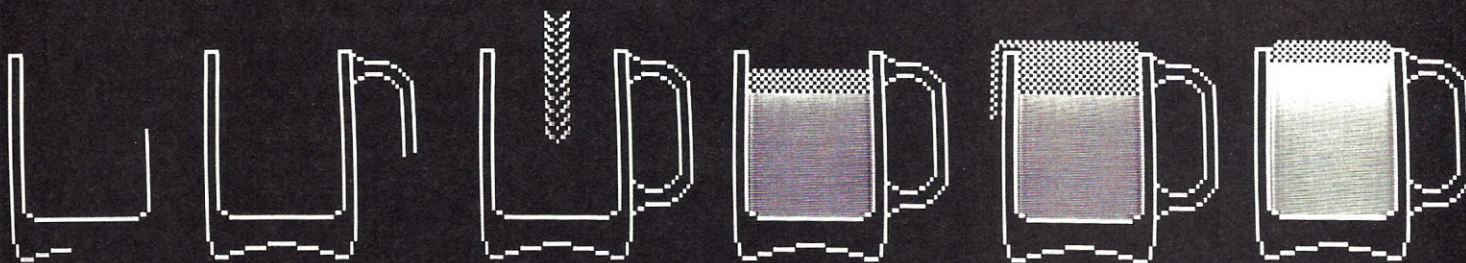
Written by Fred D'Ignazio and illustrated in full color by Stan Gilliam. 42 pages, casebound, \$6.95. (12A)

A t-shirt with the Program Bug is available in a deep purple design on a beige shirt. Adult size S, M, L, XL. Children's size S, M, L. \$5.00.



To order, send a check for books plus \$2.00 shipping and handling per order to Creative Computing, P.O. Box 789-M, Morristown, NJ 07960. NJ residents add 5% sales tax. Visa, MasterCard, and American Express orders are welcomed. For faster service, call in your bank card order toll free to 800-631-8112 (in NJ call 201-540-0445). Or use the handy order form bound into this magazine.





## Creative Animation

# THE CROWD STOPPER

David L. Ross

What do a popcorn popper, diesel engine, birthday cake, beer mug, and a corporate logo have in common? Not much, you say? No so. These items, and countless others, can be computer-animated for display on a color TV screen or monitor in a visually fascinating fashion.

But why would anyone want to animate a popper or beer mug, I hear you cry. It's an area of advertising for which the waters are virtually uncharted. Because people enjoy watching the creative process of image development on the screen, computer animation is an effective promotional tool. Whether the display is placed in a trade show exhibit, store window, building lobby, or permanent product display, the results are impressive. The creative motion on the screen attracts a crowd in a way that a static display or sign seldom does. If cleverly done, animation communicates information to viewers in an entertaining, colorful way. In effect, it's a localized "TV spot" that runs continuously and grabs the attention of passers-by—at a fraction of the cost of regular network or videotape alternatives.

We recognized the universal appeal of the TV screen in early 1979 and began to investigate the possibilities inherent in the use of computer-controlled message displays. At that time, the closest application of this nature was the continuous scrolling of text commonly seen in hotel lobbies and other public areas, announcing meeting rooms, schedules, etc. Such displays are primitive—they're visually boring and can easily be ignored by viewers. Recognizing the potential of and need for more visual impact, we began developing graphic displays to communicate key points, using

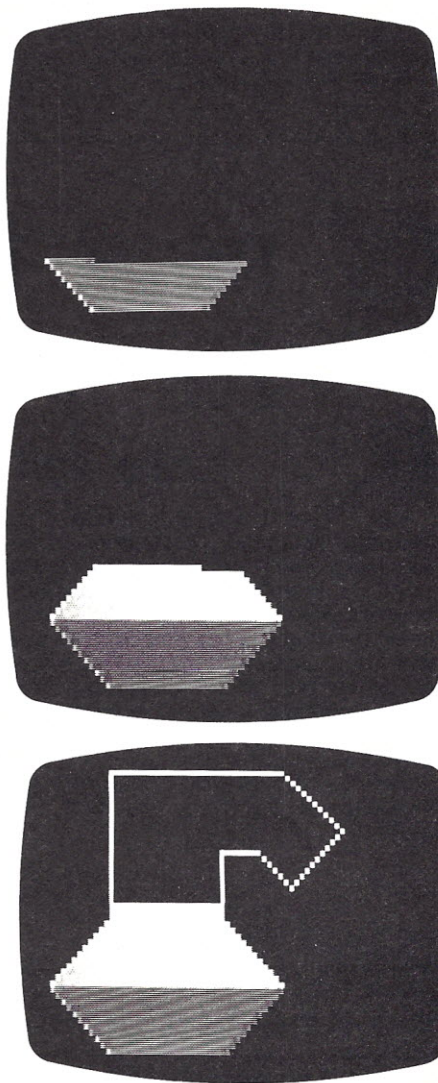
text only where necessary. Today, our presentations are 70-80% customized color graphics.

We're building a library of animation sub-sequences that can be "dropped into" larger productions—speedboats, champagne glasses, iced cakes with burning candles, flags. We're also developing software vehicles that make program customization, such as the inclusion of corporate logos, a simpler process. A further extension of this concept is the marriage of the video game and advertising presentations, in which the viewer actually participates in the exhibit. This is becoming a powerful "draw," particularly in trade shows. Promotional messages related to the game in play and/or the exhibitor's products and services can be entered from the keyboard, allowing "instant customization," or embedded directly in the program. The originality of this advertising concept, as well as the portability, reliability, and cost of small computers makes the Crowd Stopper an attractive alternative to videotape players or other traditional display devices.

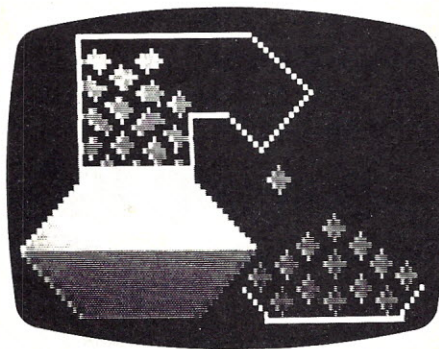
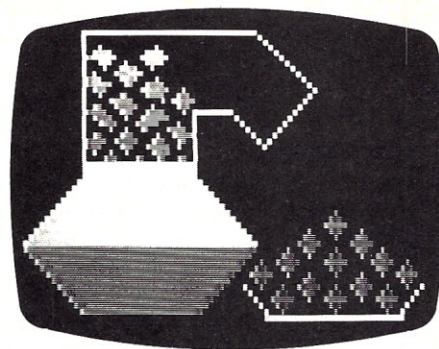
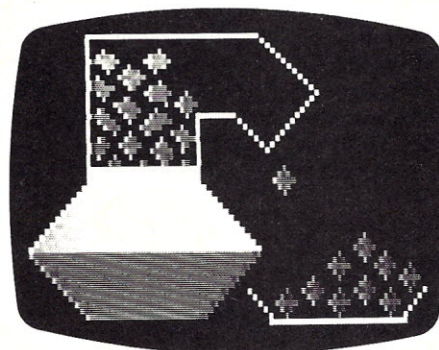
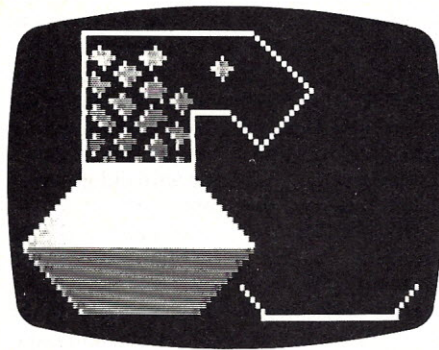
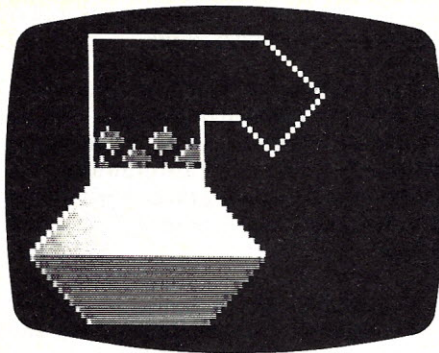
### The Popcorn Pumper—Custom Animations

Our popcorn popper animation is summarized in eight frames taken from an animated presentation developed for Wear-Ever Aluminum, Inc., a subsidiary of Alcoa, for trade show display use. Like most animations, it relies heavily on the impact of imaginative development on the screen; it has to be seen in action to fully appreciate the effects. The Popcorn Pumper is drawn on the screen in two colors—yellow and white (just like the real product)—on a black background. The base and chamber outline are built at a variable rate, with

The importance of image development is illustrated in the popcorn popper animation sequence.







accompanying musical tones. Then we add the frenzied motion of popcorn actually "popping" in the chamber, complete with sound effects, and spill it out into the waiting bowl. Viewers invariably chuckle over this part of the presentation, and stay to watch the image development a second, third, ... time.

The popcorn popper was one of four products animated in a single program for use in Wear-Ever's Housewares Show exhibit. The presentation achieved its goal, stopping traffic in the aisle and creating interest in the Popcorn Pumper and other products Wear-ever manufactures for the home. It was so successful that the company has reused it numerous time in other trade shows.

### Animations—Getting Started

To produce an effective animated display, we follow the procedures generally used in preparing speeches and written materials, with minor adaptations:

- Understand your audience. Who will primarily be viewing the presentation? Are you trying to attract the attention of adults or children? Men, women or both?
- Define your objectives. Do you want the animated presentation to sell the product or service and provide technical information as well? Or do you wish to simply stop and entertain the passing crowd? If so, for how long? What interaction with viewers do you want to effect? Will an "animated billboard" meet your goals? Or, do you want to use interactive advertising—customized video games with interweaved promotional messages—to invite participation in the exhibit and hold the viewers' interest long enough to allow company representatives to make personal contact?
- "Storyboard" the entire presentation. Try to achieve balance in the visual material, keeping it directed toward the anticipated audience and defined objectives.
- Develop the graphic images, transitions between images, and other highlighting effects, varying the animation techniques for high visual impact.
- Review the production with the client, and expect to make modifications and improvements. Seldom, if ever, is the first production the final version. Improvements can always be made.
- When approval of the presentation is final, make arrangements to watch the presentation in actual use. Is it effective? How well does it compete for people's attention in the environment in which it's being used? What portions are visually dull and need to be improved? Is the presentation meeting your defined objectives? Make note of needed modifications for future use.

An interesting phenomenon in computer-animated displays is that people's attention is generally held over multiple viewings. If you watch people in the vicinity of a presentation, you'll see their eyes continually

drawn back to the screen—no matter how many times they've seen it before. You can use this as a barometer of the presentation's effectiveness.

### Rules of Thumb for Successful Animation

We've evolved a set of guidelines that we believe differentiate good animated presentations from poor ones. While there are exceptions, these "rules of thumb" generally yield effective displays:

1) *Never scroll text vertically on the screen.* The human eye does not easily read material presented in this manner. More effective methods include partial screen wipes, erasing material by overwriting it in the background color, etc. The speed at which text is output to the screen and length of time it remains there are also important factors.

2) *Keep in mind that the method used to put the image on the screen is more important than the end result.* If the reverse were true, then a photograph or videotape of the actual product would be sufficient, as well as more technically accurate. Animation has the appeal of the quick sketch cartoonist at an amusement area. He holds his viewing crowds while he's drawing the picture, but tends to lose a large portion of this crowd and potential customers upon completion of the sketch.

3) *Always keep motion on the screen.* Avoid totally static screens by including at least slight movement with color changes, flashing, moving stick figures, etc. Motion ensures that viewers' eyes will stay glued to the screen—they want to see what will happen next.

4) *Avoid painfully slow image development, as it strains the viewer's interest in the display.* Faster graphics can be achieved by using broader lines or simplifying internal calculations that produce the image.

5) *Use unusual sequences to draw images.* This provides an element of surprise in the presentation and creates suspense. For example, if you need to draw a rectangular box, rather than using a single continuous line, consider drawing pairs of parallel lines going in different directions simultaneously. Or, if you want to include the American flag in your animation, don't draw it one stripe at a time—that's far too obvious. One approach you might use is to draw all red stripes simultaneously in one direction, followed by all the white stripes in the opposite direction, then add the blue field and output stars in a seemingly random fashion. The idea is to create suspense and pique the viewers' interest in whatever image you're producing.

6) *Vary the speed of the presentation.* Depending on the image and effects desired,



## Crowd Stopper, continued...

vary the speed accordingly. Don't draw everything as fast as possible—but allow the viewer to savor the image development. On the other hand, don't let a portion of the presentation drag enough to evoke a visual yawn.

7) *Use color for emphasis.* Color-code key concepts to improve viewer comprehension of the material. But don't carry this too far and use too many colors on a single screen simply because the computer has the capability of doing so. "Color overload" is as poor as a dull black and white presentation.

8) *Choose color combinations carefully.* Use colors that match the objects of animation if possible. Vary the color combinations throughout the presentation, but make sure all combinations are aesthetically pleasing, taking into consideration the audience, locations, and objectives.

9) *Use sound effects, if available on the computer, to highlight the animation.* In our beer mug animation, for example, sounds accompanying the graphics simulate the sounds of beer flowing into a mug, varying with the rate of flow and the fullness of the mug. Try to imitate sounds as appropriate to the image, but don't use a lot of non-related sounds, because in time

they become annoying rather than entertaining. Also, don't continuously use sound for sound's sake in the presentation. Sounds add another dimension to the presentation, but too much sound will actually reduce, rather than augment, the impact.

10) *Use variety in message display.* experiment with three dimensional lettering, oversized letters, word swimming, color rolls, fades, and wipes. Words can be "shot out of cannons," color-highlighted, or "spoken" by animated characters or stick figures. Be sure that the text is readable by viewers, considering their distance from the screen, the screen size, lettering size, and duration held on the screen. You might also program the capability, as we do, of message input from the keyboard to allow last minute changes in presentation messages. This adds further flexibility.

11) *Add humor to animations.* If your audience laughs, they'll watch longer. People love to be entertained.

12) *Pay special attention to transitions between graphic images.* Don't always clear the screen before producing another image. Allow one to evolve into another some of the time.

13) *Don't rush.* Good animations take time. Experiment with different ways of producing a single image and determine which is

most visually effective, as this invariably leads to a better final result.

14) *Don't prejudge or limit your animation possibilities.* Life can be imposed even on lackluster objects such as a frying pan or toaster by the way they are drawn and the addition of a flickering flame beneath the pan or toasted bread "popping" out of the toaster.

A cardinal rule of animations is that they improve with experimentation and experience, provided enough time is allowed to do the work. Did I say "Work"? Yes, there are hours of work in every animation, but it's one of the most imaginative applications for home computers, and can give more sheer pleasure and satisfaction than other types of programming. It's enormously gratifying to watch people become enthralled with and chortle with delight over a particularly clever presentation.

So, consider the possibilities! Almost anything can be animated. We use the Interact computer, Microsoft Basic, and machine language to produce most of our animations. However, it's not so much the computer or language that you use, but the imagination that you put into programming the display that makes the difference. Give animation a try on your own computer. We think you'll find it will open up a whole new world of programming enjoyment and creativity for you. □



## NEW FOR THE APPLE

### A NEW CHALLENGE

DOGFIGHT will capture your imagination. You are the pilot of a jet going into combat. You may fly alone on this mission, or you may have another pilot flying with you to defeat the enemy. First you fly against one enemy jet. You are in complete control: fly faster or slower, turn left or right—but most importantly, FIRE. If you are shot down, and you act quickly, you can bail out. You and your parachute float gently downward, hoping an enemy plane does not shoot you. If you survive, you will quickly return to the fierce dogfight. The enemy can also bail out!! You must shoot him down before he has a chance to return.

### THE ENEMY RETURNS

Each time you defeat all enemy jets or helicopters, you advance to the next

level where you fly against faster and/or more enemy planes. There are sixteen levels of difficulty to fight through. Bill Basham, the talented author of this high resolution program, has made it through only 8 levels before his planes were destroyed.

### MANY WAYS TO PLAY

DOGFIGHT may be played in several different ways. You, alone, may challenge the computer, or, two players may fly against the computer—either on the same team or on different teams. With DOGFIGHT you can create your own custom game with as many as eight players crowding around your Apple keyboard controlling their own planes. You may select jets or helicopters on any level—be a daredevil with 7 computer jets against you. You are in charge with the custom mode.

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### AVAILABLE NOW

The Dogfight is available on disk at your Apple Dealer for \$29.95.

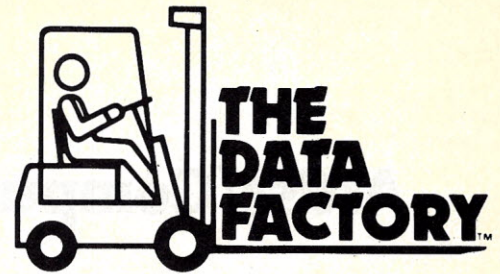


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The latest breakthroughs in a data base system have been incorporated into Bill Passauer's program. The unique new feature that sets it apart from all others is its complete modifiability. You may rearrange your data, removing part of it from the original disk, and form a new data base without reentering the data again. Add, delete, replace, or rearrange and compare fields or data at any time. Do an incredible 20 level search.

The program has no limitation to the amount of fields you can have within the limits of your computer. Your field lengths can have a maximum of 239 characters for each field and you can enter ANY CHARACTER as data (commas, quotation marks, etc.).

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Any one can use it. The program prompts you as it runs. The easy to follow manual leads you through the set up of your data base and all the features. "The Data Factory" is organized in nine program modules. Only the module being used is loaded into memory to manipulate data, rather than the entire program. This saves memory for manipulating data rather than for program storage. There are so many other "common sense" features that set it apart from all others.

### **A UNIVERSAL SYSTEM**

You may use "THE DATA FACTORY" at home or at work. Set up: Inventories, Mailing Lists (a printer is needed for mailing labels); Sales records; Accounts payable or receivable; Budgets; Library, recipe, or phone directories; Appointment calendar; Notices of subscriptions, license or warranty dates; Working or shopping lists, and many other applications that you will discover. All of the above can be accomplished from this one disk oriented program. No need to have separate costly programs for each purpose. With all the data on a disk, you can manipulate the information more easily and efficiently. Find any record using the record number, the data entered or any variation of the data in your data base. The from/to feature selects records by dates or amounts.

### **REQUIREMENTS**

"The Data Factory" is presently being offered in APPLESOFT but will be available in other forms of basic shortly. Check with your dealer for other software varieties currently being handled. You will need 48k and Applesoft in ROM. "The Data Factory" is as powerful with one disk drive as with two. You do not lose any of its capabilities using only one disk drive. A printer is optional.

### **INSURANCE POLICY**

Micro Lab is instituting a revolutionary new policy for the public: Micro Lab Disk Insurance.

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### **AVAILABLE NOW**

"The Data Factory" is being offered nationally for the first time. It has been marketed and tested on a local level and has been received with a most enthusiastic response from both dealers and users.

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# Artist/Computer Dialogue

**Bernard Demio**

In his creative approach the artist uses a mini-computer in the following manner: (see diagram).

## First Stage:

Starting from a basic idea, the artist does some preparatory conceptual work in the form of drawings, rough sketches, and various other attempts. He defines the constraints of his creative work and that which he wants to express or omit. (For example the definition of the initial generating forms).

## Second Stage:

Setting up the formal computer language for these forms, the colors and the controls for the envisaged composition. Eventually returning to certain elements defined during the first stage.

## Third Stage:

Artist/mini-computer dialogue. Given a work program adapted or chosen by the artist (program of forms or colors, in low or high resolution), the computer will establish the relation between the data of the composition defined during the first stage, and this work program.

The program will process the data and suggest combinations to the artist.

As a function of his investigations, the artist will be able to explore one path of testing rather than another.

In exploring a path, the artist will have new ideas which he may or may not reintroduce as data. He will think of new composition controls which will enable him to quickly put into effect his ideas. He will then be able to decide whether he will keep the results of his testing path.

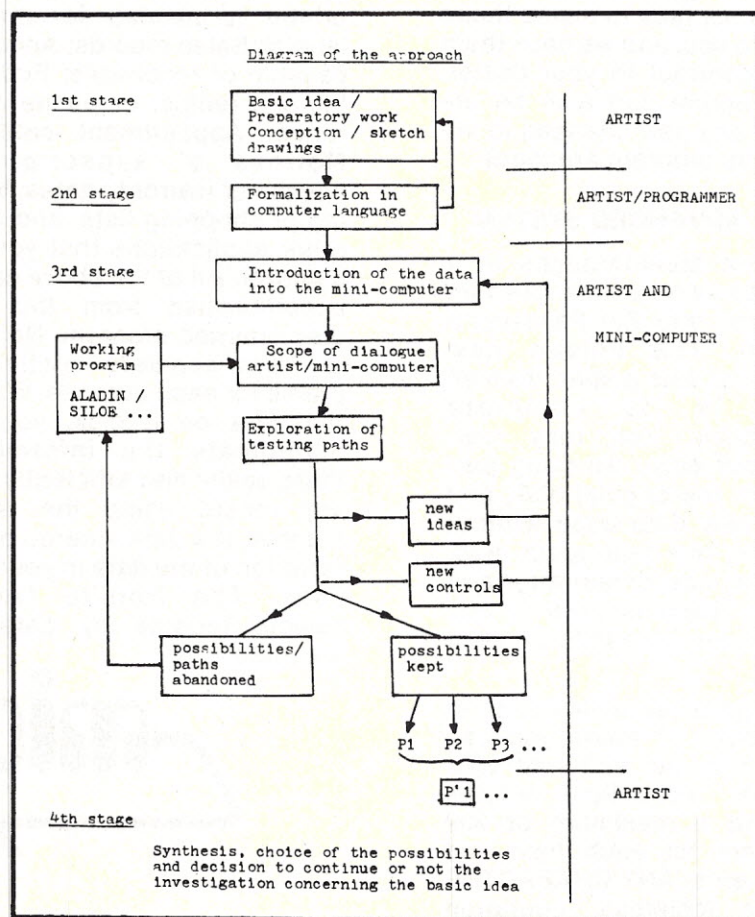
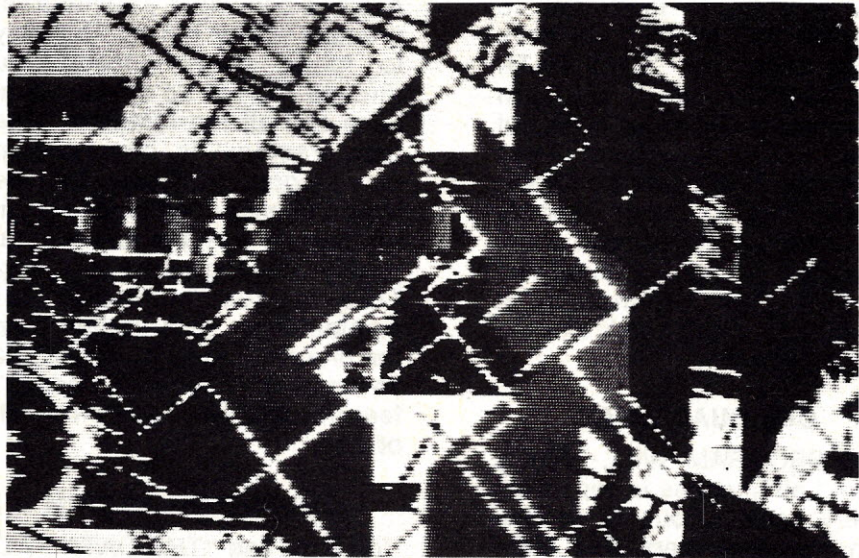
If he is not satisfied, he will pass on to the exploration of another testing path.

At the end of the processing/dialogue, he will thus have for his investigations one or two possibilities corresponding to his creative controls defined in the first stage: or modified along the way.

## Fourth Stage:

A synthesis by the artist of the different possibilities issuing from the 3rd stage, and the choice of one possibility or the continuation of the investigation. □

Reprinted from PAGE, the publication of the Computer Arts Society. For membership information, write Kurt Laukner, Math Dept., Eastern Michigan Univ., Ypsilanti, MI 48197.



Bernard Demio, 12 Rue Rambuteau, 75003 Paris.





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# Permutating Lines

*Torsten Ridell*

The images reproduced here are some examples based on my idea of "permutating lines".

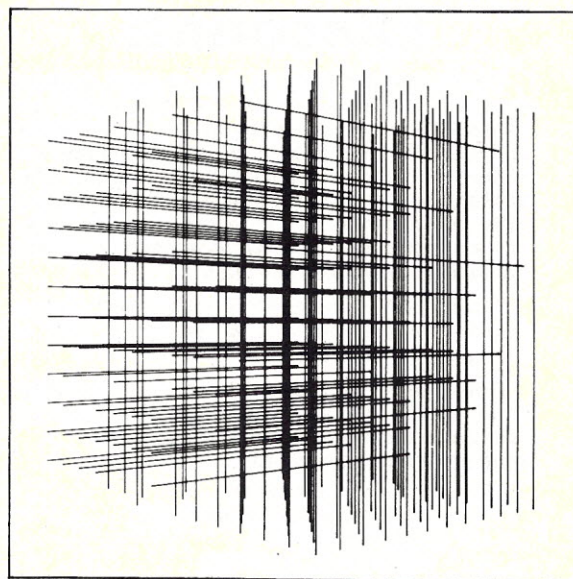
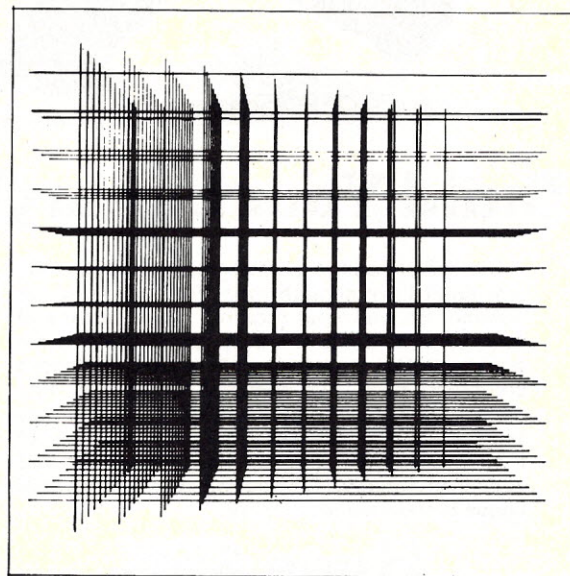
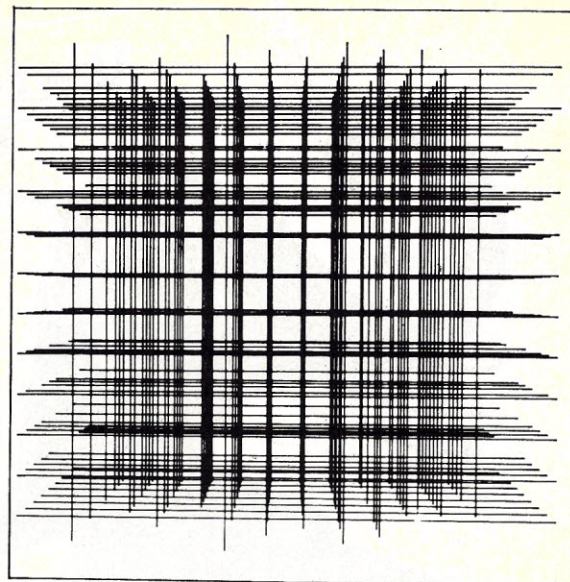
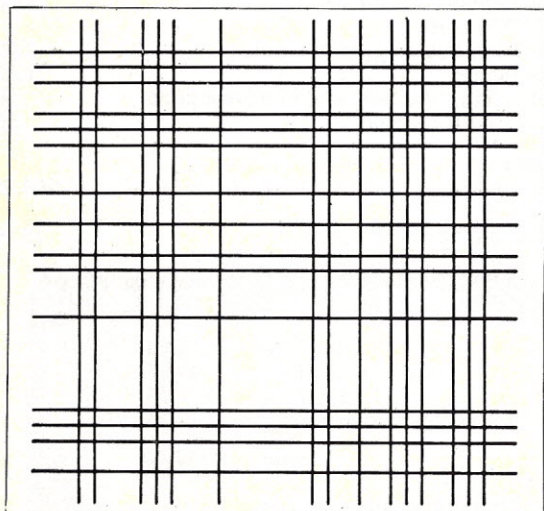
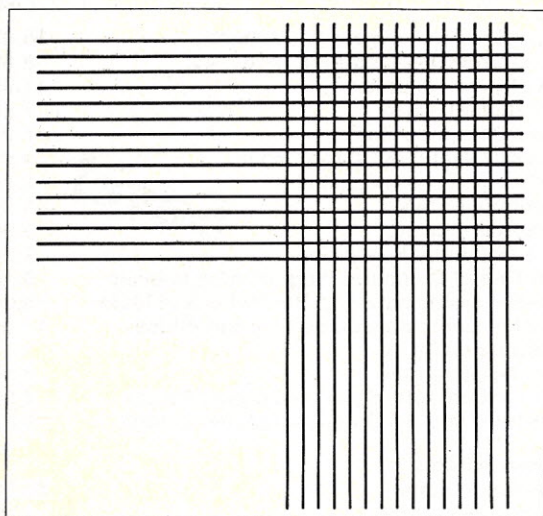
On a given surface, there are both horizontal and vertical positions for lines. These lines are distributed either systematically or aleatorically, resulting in a series of two-dimensional images.

I next tried to combine some of these series to create a three dimensional image.

Each of the serial progressions of lines was used as a section through a cube where the distance between each line is equal to the distance between each section. By rotating each cube on its axes, I obtained a new set of drawings whose serial progressions are in three dimensions. (opposite).

For the earlier series of drawings (two of which are shown here) I used the machine for its capacity to make repetitive movements, in order to achieve the desired precision. For the later series, of which three are shown, the computer itself played a determining role: it allowed me to "see" my ideas as concrete visual forms, giving rise to some highly complex images which I would have found difficult to realize by traditional methods, or of which I might never ever have conceived.

It is for this reason that I regard the computer not simply as a useful tool, but as being complementary to my artistic creativity. □



Torsten Ridell, 754 Rue Charlot, 75003 Paris.

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Sample Lineup

SUPER STAR BASEBALL  
Sample Lineup

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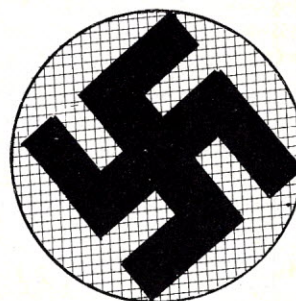
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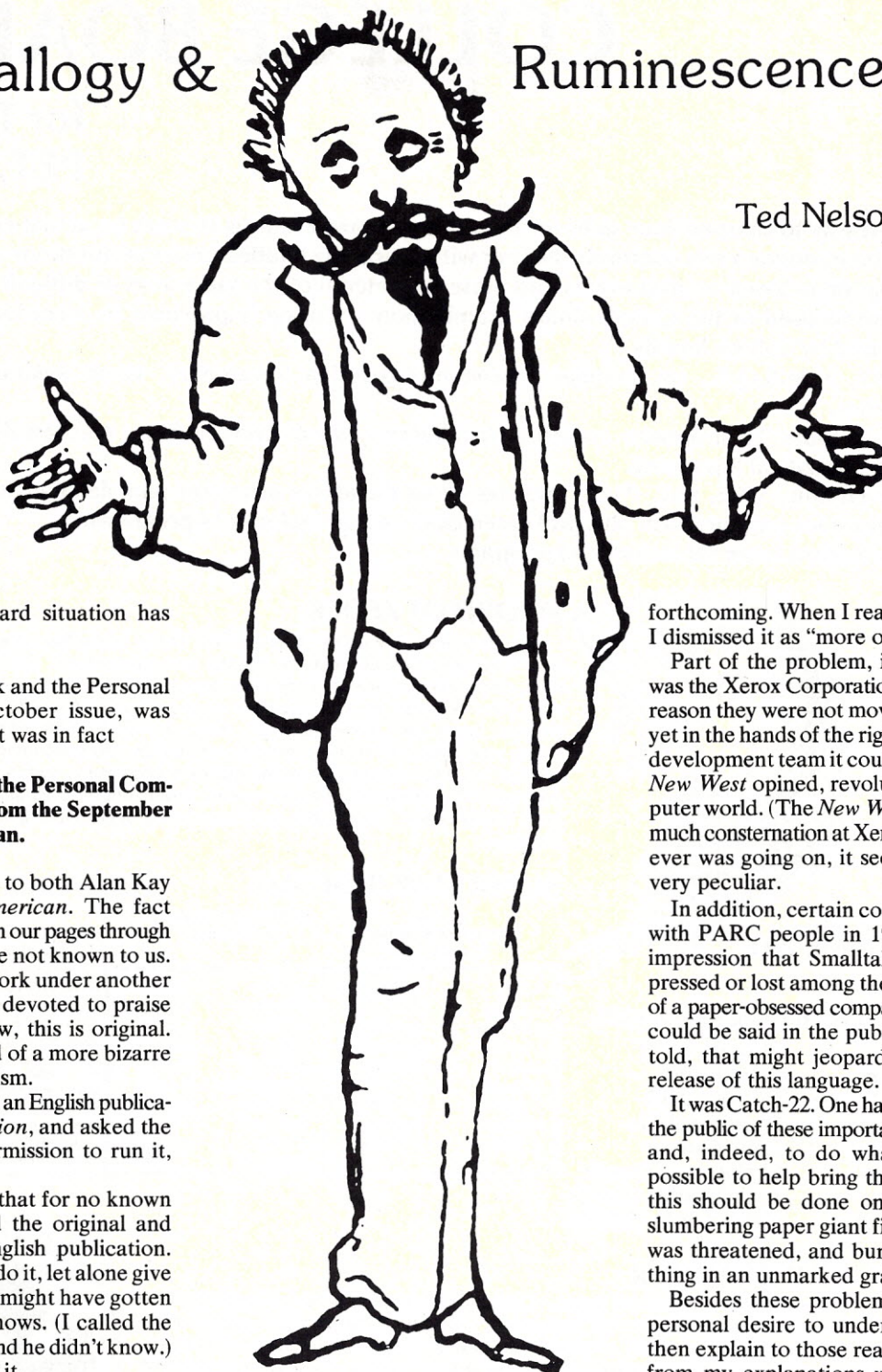
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# Appallogy &

# Ruminescence

Ted Nelson



An extremely awkward situation has arisen.

The article "Smalltalk and the Personal Computer," in our October issue, was incorrectly identified. It was in fact

**"Microelectronics and the Personal Computer," by Alan Kay, from the September 1977 Scientific American.**

We hereby apologize to both Alan Kay and The *Scientific American*. The fact that this piece appeared in our pages through plagiarism was of course not known to us. But to reprint a man's work under another name in a issue largely devoted to praise of the real author—now, this is original. We have not ever heard of a more bizarre and astounding plagiarism.

We found the article in an English publication, *Computer Education*, and asked the putative author for permission to run it, which he gave.

It turns out, though, that for no known reason he had retyped the original and submitted it to the English publication. What possessed him to do it, let alone give us permission, when he might have gotten away with it, no one knows. (I called the culprit and asked him, and he didn't know.) He may lose his job for it.

We need not dwell on this unfortunate individual and his curious acts. What remains to be explained is how we failed to recognize the piece.

I read it, of course, when it originally came out; and like some other sophisticated readers I have talked to, I found it woolly and unhelpful. What was the *structure* of Smalltalk, this marvelous language, I wanted to know; but the examples in the article were unfathomable, and all the talk about children was off the point.

Many people had by 1977 seen the Smalltalk language and its marvelous capabilities, either as guests at Xerox Palo Alto Research Center or in the movies their researchers showed at conferences. Everyone was awed; many were frustrated by the lack of information on the language itself, or why it was so special.

My frustration ran deeper than most people's. I had been a guest of Xerox PARC as early as 1972, and had considered Kay's answers to my questions evasive and not

forthcoming. When I read the 1977 piece, I dismissed it as "more of the same."

Part of the problem, it seemed to me, was the Xerox Corporation itself. For some reason they were not moving on this thing; yet in the hands of the right marketing and development team it could, as an article in *New West* opined, revolutionize the computer world. (The *New West* article caused much consternation at Xerox PARC.) Whatever was going on, it seemed to me, was very peculiar.

In addition, certain conversations I had with PARC people in 1978 gave me the impression that Smalltalk might be suppressed or lost among the corporate gears of a paper-obsessed company. Thus nothing could be said in the public presses, I was told, that might jeopardize the eventual release of this language.

It was Catch-22. One had a duty to inform the public of these important developments, and, indeed, to do whatever might be possible to help bring them forth; yet all this should be done on tiptoe, lest the slumbering paper giant find out the paper was threatened, and bury this wonderful thing in an unmarked grave.

Besides these problems, I had a great personal desire to understand it all, and then explain to those readers who benefit from my explanations what this was all about.

A number of breaks occurred in 1979. One was the appearance of a technical paper on the internals of Smalltalk—a sign, I had been told, that Smalltalk might eventually be released. And two fellows from Texas published a paper on their own version for the Z80. Moreover, I became editor of this magazine, giving me time and telephones to probe into these matters.

So a special Smalltalk issue was projected,



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## Appallogy, continued...

first for October, then for August, then October again.

The original idea was to do a special issue on Smalltalk itself. But it had to be done without the cooperation of Xerox Public Relations; dealing with them before had been a waste of time, and they, too, appeared to be covering something up.

The objective of the special issue was to get at the parts of the Smalltalk idea that the Xerox people were not publishing—especially the syntax (or lack of it), and the ways that Smalltalk functions are defined and redefined to give you the custom language you actually want, even as your idea of what you want is changing.

However, I did mention these plans to the PARC people, and got the old story: "Don't jeopardize what we're doing, we're trying to get the language out." So the piece was broadened to "actor" languages in general, and I omitted the most important statement that should have been made, although the astute reader may have seen it twinkling at him between the lines:

**Smalltalk is the most important computer language anywhere, and will probably revolutionize the computer world.**

As it happened, our October issue came out just after the meeting of SIGSMALL/SIGPC in Palo Alto, where Adele Goldberg of Xerox PARC announced that the Smalltalk language will in fact be put in the public domain by Xerox with the publication of a many-authored book on it, sometime in mid-1981.

And so, in the ringing phrase of the 1940s, Now It Can Be Told.

**Smalltalk is the most important computer language anywhere, and will probably revolutionize the computer world, and the rest of the world as well.**

In any case, when Dave Ahl showed me the Alan Kay piece, as reprinted in *Computer Education* over a different author's name, I still didn't like it. It seemed to me woolly and vague. But I tossed it on my heap of technical papers on Smalltalk and actor languages.

The October issue gradually took shape around my piece and others, explaining both the history and inner structure of Smalltalk and the other actor languages. I had learned a good deal, especially from MLT people and papers. And I picked up *Computer Education* again a couple of times, and began to see something in the piece; especially since I now knew what actor languages were about and how Smalltalk functions are defined and redefined. Browsing, I thought, Hey, this is pretty good.

So we asked for permission.

And as I did the preliminary layout on the article I read it again and thought,

"Gee, this is *really* good, why haven't I heard of this guy before?"

Any reader knows that a thing changes between readings. If you read a book or an article one year, and then again five years later, it may say something entirely different to you; your mind is differently prepared, meanings and qualities and points stand out that hadn't before, and perhaps the earlier overall impression has changed because of what you have seen in the meantime.

So it was that I failed to recognize Kay's article. It took several readings, and a general understanding of the language's unique inside-out, upside-down structure, before the depth and wit of his words got through to me. Proving once again that Alan Kay is far ahead of us all.

So after much fuss and bother I finished with the two-part actors piece and took a trip to the Far East. And when I returned I found out we had botched it, and offended Dr. Kay, for we had indeed run his very own original article.

The editor's nightmare had come true. We had published a piece submitted fraudulently by someone other than its author. (The fact that it was not submitted to us, but that we found it in the plagiarized version and failed to recognize it, is just more complication.)

Well, it all got sorted out, and I had some very agreeable chats with Alan Kay and Adele Goldberg and the publisher of the *Scientific American*, and they were all very nice, and the matter is done with. So all's well that ends well. (Except for the culprit, who pretty much asked for what he got.)

Both Dr. Kay and the publishers of the

*Scientific American* have been very understanding of our position in this affair. Kay's reputation certainly has not suffered, nor has that of the *Scientific American*. For us it's a different story.

In that glorious new volume, *The Next Whole Earth Catalog*, which came out about the same time as our October issue, it says that *Creative Computing* sometimes doesn't check its sources and publishes plagiarized material.

How could they have known, given that they went to press before we did?

And, realistically, how in the world can a publication protect itself against plagiarized submissions—especially if the editors *haven't* seen the piece to begin with?

It's just a risk we take if there are to be magazines.

\* \* \*

"Those Xerox PARC people—they're so stuck up," someone said to me at a party recently.

That's not it, exactly.

They're on the other side of the looking glass, and there's too much to explain, so they speak in playful terms and Sufi parables.

I hope that the October and November issues, in their small way, may have reduced the explanation gap, so that others can better understand the Delphic sayings of the PARC people.

There is no question that one of the two or three most important places in the computer world is Xerox PARC. We will continue to follow their doings and influence in these pages, I hope now with a little more understanding on both sides.

There is much I disagree with in their approach and views of what people need. I think they were wrong, for instance, in waiting so long, and perfecting and perfecting, before putting Smalltalk out to the public. While the team's glacially-slow perfectionism has produced a magnificent product, I would argue that the world would be a much better place now if we could have had their discards five years ago. (An Apple with the Rosetta language—representing approaches PARC discarded—would more than meet my own day-to-day programming needs, and do so far better than Basic.)

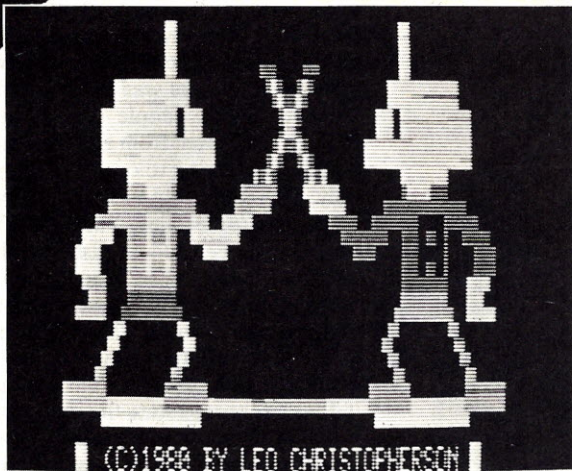
It comes down to what you think of the future. If we had decades to fool around, well and good—but with both thermonuclear war and global famine on the horizon, time lost is lost indeed. Time is short; we are a lot closer to Armageddon; and the better future through personal computing is still almost as far away as it was when the Altair came out. (The hardware turkeys are still gobbling up circuit specs, and people are still using idiotic words like "microcomputer". But there is at least one reliable keyboard machine with disk, and there is at least Visi-Calcul.)





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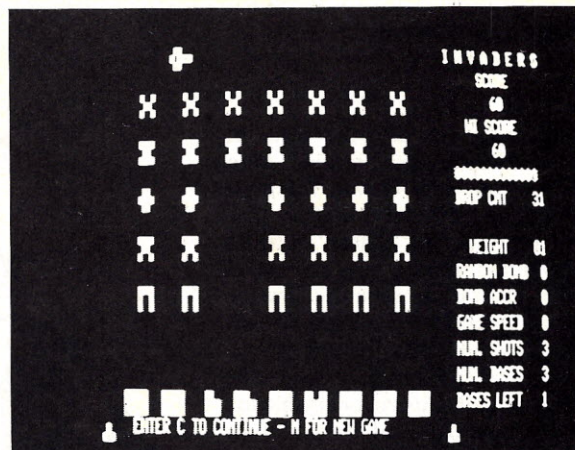
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## Appallogy, continued...

\* \* \*

This is, I suppose, also the place to respond to the September editorial in *Byte*. For those who missed it, or were mystified by it, it was an editorial *à clef* by Carl Helmers, the Founding Editor, in which several unnamed persons were accused of unethical conduct under vague and mysterious circumstances. If you didn't already know who or what it was about there was no way you could actually find out. However, it was all quite recognizable to a few hundred people, and indeed quite libelous.

The facts are these.

Scott Warren and Dennis Abbe, of Houston, Texas, have for two years been working on an actor-language interpreter for the Z80 under CP/M. In structure this most closely resembles Smalltalk, developed at Xerox PARC and discussed in our October and November issues.

In 1979 Warren and Abbe published a paper, referring to their language as an implementation of Smalltalk, and using the trade name Rosetta. They received one call from a member of the PARC team, who expressed interest in their work. Though their intentions were openly commercial, at no time did anyone from Xerox PARC (or elsewhere) correct or criticize their use of the name "Smalltalk."

Now precedent in this matter is plain. Languages are referred to generically, and anyone is free to create "a Basic" or "a Fortran" with any features he likes. (I have often said that you can sell any language as long as you *call* it Basic, and one compiler, "Basex," is widely mistaken for Basic even though the resemblance is debatable.) As the Rosetta effort resembled only one other language, Smalltalk, and as there had been no attempt to assert trademark on the name "Smalltalk," or correct or censure them for this usage, Warren and Abbe assumed that the use of this name had been in some sense "cleared." (And, indeed, no one could deny that theirs was in some important sense a *dialect* of Smalltalk.)

Okay, so I met these guys in March and thought their work was terrific; even though, obviously, it was far short of the Xerox Smalltalk, it would run on the Z80 and there was no guarantee we'd ever get anything else; The Überkorp might quash it.

So, as mentioned in earlier issues of this magazine, I made a couple of phone calls and got Warren and Abbe a place to show their wares at the National Computer Conference as guests of Exidy, Inc., running the language on a Sorcerer. I also helped with a couple of brochures: one explaining the general structure of the language, the other describing now I hoped to use it in conjunction with a long-term project of mine.



The names of Xerox PARC, Alan Kay et al., did not appear on the brochures, any more than the name of John Backus appears on Fortran brochures or the names of Kemeny, Kurtz and Dartmouth appear on advertisements for Basic. (However, in an article in the NCC issue of *Datamation* called "Introducing Rosetta Smalltalk," Warren and Abbe gave fulsome credit to the language's originators. Nor did I, in our symposium on actor languages, neglect to credit the PARC group.)

So much for the events which some people, at least the Founding Editor, seem to consider the crime of the century. It is alleged that in some way the Rosetta guys (and I, singled out for special obloquy as "the publicist" in the *Byte* thing) either tried to withhold credit from the creators of Smalltalk, hide its origin, or somehow pretend we had invented it ourselves.

This is almost too silly to reply to. But not quite.

The misunderstanding was a simple matter of paradigm. If you consider Smalltalk a generic language-name, like Fortran and Basic (and, since it has never been seen with a trademark sign, one might think that), then anyone can create a dialect and use that name in the time-honored fashion. But if, as was made abundantly clear by certain people's reactions at the NCC, it is different from all other language-names in applying to one implementation only, then that could and should have been made clearer earlier. Such clarification could have been accomplished with much less hard feeling at such an earlier time.

Apparently people are still going around saying it was "obvious" that the term Smalltalk could *only* be applied to the Xerox product. Well, obvious is as obvious does; it does not hurt to state the obvious so that it will be obvious to others too. Those who insist that this misunderstanding could not have arisen in good faith force a diabolical and vicious construction upon these events, and are then required to squirrel around for a darker motive than commercialism and enthusiasm; they will not find it.

It all seems to be over now. The Rosetta people have agreed to change the name of their product, but aren't sure there's a market for what they've got.

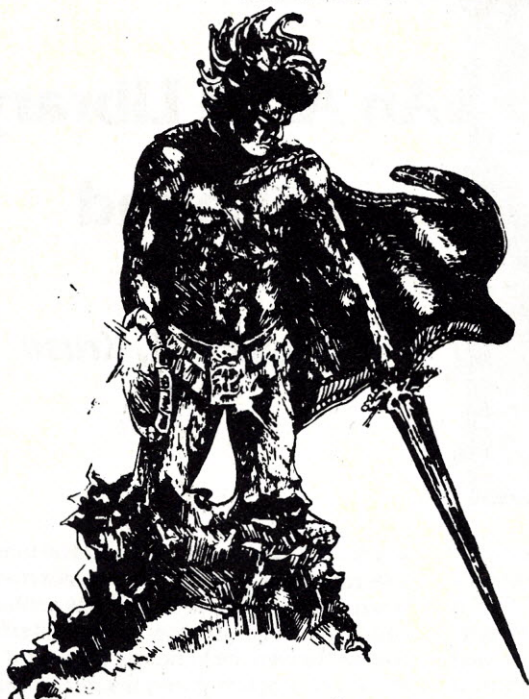
The *real*, and indeed now the One and Only, Smalltalk is to be released (mirabile dictu!) sometime next year, so save your money for whatever it will run on. The software is free—and worth millions.

But in putting this matter away, I must also respond to the personal slurs by the Founding Editor on my own career. These were very clear: to wit, he alleged that I am simply an opportunistic and shallow flack looking for the Main Chance to become a parasite on someone else's serious endeavors. He put it surprisingly well, dismissing with unusual finesse my twenty years' work as designer and theorist of interactive computer systems. It is interesting to watch your work just swept aside like that, billowed away like a house on a flood. I have never seen the life-work of any living person dismissed in such a sweeping manner by a fellow professional, and it leaves me breathless. But I will fight back the temptation to reply in kind. And I will let pass the Founding Editor's statement that I and the Rosetta guys deliberately represented work by the people at Xerox PARC as our own. The statement is both libelous and asinine. Someone has indeed recently palmed off Xerox PARC work as his own—alas, in these very pages; but it was not, as mentioned earlier, I or Warren or Abbe.

In the spirit of general clarification, reconciliation and anticipation, I suggest we put all these matters to bed. We all need to get ready for Smalltalk, the One and Only. □



# A New Type of Game



**MISSION IMPOSSIBLE ADVENTURE** (by Scott Adams) - Good Morning, Your mission is to... and so it starts. Will you be able to complete your mission in time? Or is the world's first automated nuclear reactor doomed? This one's well named, it's hard, there is no magic but plenty of **suspense**. Good luck.....

**THE COUNT** (by Scott Adams) - You wake up in a large brass bed in a castle somewhere in Transylvania. Who are you, what are you doing here, and WHY did the postman deliver a bottle of blood? You'll love this Adventure, in fact, you might say it's **LOVE AT FIRST BITE**.....

**ADVENTURELAND** (by Scott Adams) - You wander through an enchanted world trying to recover the 13 lost treasures. You'll encounter **WILD ANIMALS**, **MAGICAL BEINGS**, and many other perils and puzzles. Can you rescue the **BLUE OX** from the quicksand? Or find your way out of the maze of pits? Happy Adventuring.....

**VOODOO CASTLE** (by Scott Adams) - Count Cristo has had a fiendish curse put on him by his enemies. There he lies, with you his only hope. Will you be able to rescue him or is he forever doomed? Beware the Voodoo Man.....

Welcome to an astonishing new experience! **ADVENTURE** is one of the most challenging and innovative games available for your personal computer. This is not the average computer game in which you shoot at, chase, or get chased by something, master the game within an hour, and then lose interest. In fact, it may take you more than an hour to score at all, and will probably take days or weeks of playing to get a good score. (There is a provision for saving a game in progress).

The original computer version of Adventure was written by Willie Crowther and Don Woods in Fortran on a PDP-10 at MIT. In this version the player starts near a small wellhouse. Upon entering the house, he finds food, water, a set of keys and a lamp. Armed with only these items, he must set out to explore the countryside in search of treasure and other objects of play. He must also confront dwarfs, snakes, trolls, bears, dragons, birds, and other creatures during his quest. The game accepts one- or two-word commands such as **GET LAMP**, **SOUTH**, or **KILL DWARF**. Of course, if you don't have the proper tool to carry out an action, or if you do something foolish, you may find yourself in big trouble.

In playing the game you wander thru various 'rooms' (locations), manipulating the objects there to try to find 'treasures'. You may have to defeat an exotic wild animal to get one treasure, or figure out how to get another treasure out of a quicksand bog. You communicate thru two-word commands such as 'go west', 'climb tree', 'throw axe', 'look around'.



# Adventure

For Apple, TRS-80, Sorcerer, PET, CP/M

**ORIGINAL ADVENTURE** (by Crowther, Woods, Manning and Roichel) - Somewhere nearby is a colossal cave where others have found fortunes in treasures and gold, but some who have entered have never been seen again. You start at a small brick building which is the wellhouse for a large spring. You must try to find your way into the underground caverns where you'll meet a giant clam, nasty little dwarves, and much more. **This Adventure is Bi-Lingual**—you may play in either **English or French**—a language learning tool beyond comparison. Runs in 32K CP/M system (48K required for **SAVE GAME** feature). Even includes **SAM76** language in which to run the game. The troll says "Good Luck."

**PIRATE ADVENTURE** (by Scott Adams) - "Yo Ho Ho and a bottle of rum..." You'll meet up with the pirate and his daffy bird along with many strange sights as you attempt to go from your London flat to Treasure Island. Can you recover **LONG JOHN SILVER**'s lost treasures? Happy sailing matey.....

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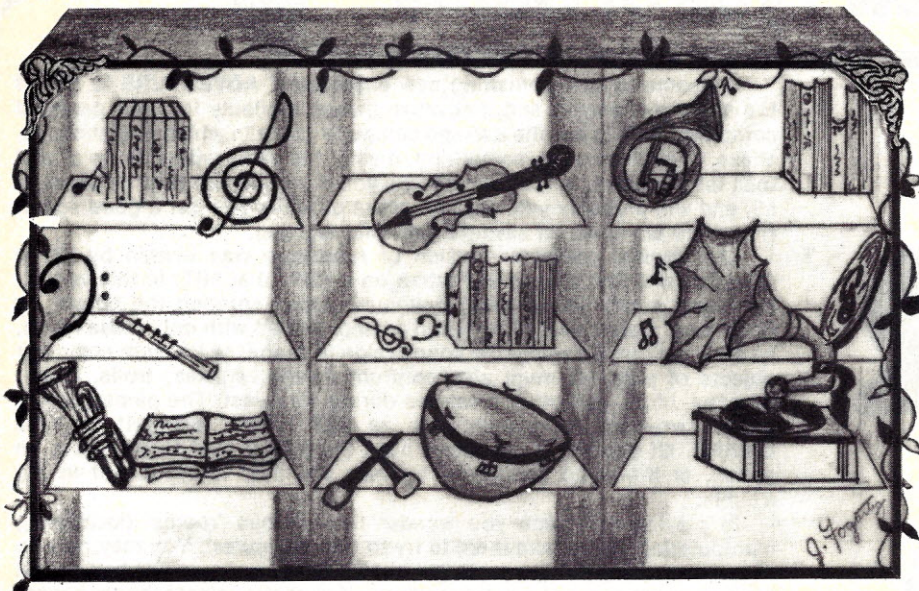
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# An Atari Library of Sound

**Richard M. Kruse**

Of the recognized human senses, it may easily be argued that the most important are those of sight and hearing. The movie industry was quick to realize the importance of adding sound to their visual productions. First there was simple background music, and later, when it became technically possible, sound was synchronized to the action. Few people today would pay to see a silent movie except under special circumstances.

Yet when most of us think of computers, we usually visualize someone sitting at a video console, typing, and staring silently into the screen. Hollywood generally adds some "bleeps" and "bloops", supposedly electronic, to the background. Real data processing centers are usually quite noisy with machinery running and several printers banging away. These are all artificial sounds, however, far removed from what all of us experience in daily life.

Personal computing, of course, need not follow the same path. If it is technically feasible, why not add the dimension of sound to the already accepted versatility of a good color graphics system? Why not, indeed! Manufacturers of small computers are responding in varying degrees to this challenge. It is now up to programmers to use this new capability effectively.

One of the outstanding features of the Atari 400/800 personal computers is the built-in sound generation system. There is no need to jury-rig an external amplifier and speaker and then operate it with "PEEK s" and "POKE s". Atari's sophisticated sound channels are manipulated through special Basic commands, and the RF output carries the sound information properly formatted to be reproduced through the speaker of a standard television receiver. The television's sound system does not have to be of especially high quality to

adequately handle the range of frequencies produced (although it certainly doesn't hurt). An added bonus of this system is that sound and video are presented side-by-side. Most people will probably find this preferable to listening to a disembodied sound source physically separated from the visual presentation.

The Ataris give you not just a single sound generator, but four identical "channels" which may be used separately or in any combination. Each channel has individually controllable pitch and volume, along with a third parameter which Atari calls "tone." The Basic statement which activates one of the sound channels has the following form:

100 SOUND P1, P2, P3, P4

Parameters P1 through P4 are integer values. P1 specifies which channel is to be activated, identified as zero through three. P2 may be any value from 0 to 255, and sets the relative pitch or frequency of the sound. In the pure tone mode, the pitch

***It is now up to programmers to use this new capability effectively.***

range is about two and one-half octaves, and by using a look-up table of conversion factors between musical notes and pitch values, playing a melody on the Atari becomes almost trivial. Playing four-part harmony can be done with some additional programming effort.

One of sixteen different volume levels (including off) is selected by the value of P4.

The tone parameter, P3, is a corker. There are eight possible values, two of

which result in relatively pure musical tones. The remaining six, however, are not really "tones" at all, but special effects settings which produce strange and wonderful sounds that will be variously perceived as trucks, helicopters, heavy machinery, and warp drives. These effects, like the pure tones, may be varied in pitch and volume. And always, two or more sound channels may be active simultaneously. As you can see, the number of possible sounds and effects is staggering. Normal sounds can be imitated and new ones created, limited only by the imagination of the programmer.

To stimulate those imaginations, and to show the methods used to put these effects to work, one dozen varied and useful sound effects are presented here. Each effect is programmed as a subroutine which will run for a certain length of time and then terminate. Each subroutine makes use of one or more sound registers, and many of them accept one or more input parameters which modify the effect and/or its running time. A brief explanation is presented for each, so that you will be able to change the effects as desired.

**1. Percussive Sound Generator**-(See listing 1)

This is a "building block" subroutine which imitates the sound of struck or plucked musical instruments or, with different parameters, explosions or gunshots.

The percussive effect is achieved by executing a loop which initially sets a high volume level, then repeatedly reduces that level by a given percentage until it falls below a present minimum. The volume reduction factor is stored as the variable ICR, and it is easy to see that changing the value of ICR will change the rate of decay of the sound. Since ICR is calculated from the input parameter DUR, the decay rate can be modified at will each time the subroutine is called. The value 10 in



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by David Mullich



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statement 10020 is the tone parameter, and results in a pure tone output, so that this subroutine will imitate a chime or bell. Statement 10010 adds a brief burst of white noise at the start of the loop. (It is turned off at step 10025.) This enhances the initial "strike" effect and is heard in the sounds of many musical instruments. Statement 10040 turns the sound off altogether prior to returning to the calling program. While this percussive sound routine will run by itself, it can also be used in the generation of more complex sounds, as will be demonstrated.

## 2. Doorbell-(See listing 2)

...Now, who could that be?...

The familiar "Dinnng, donng" of the doorbell is created by two sequential calls to a modified percussive routine. Two different pitches and two moderately long decays are used. What could be simpler?

## 3. Ringing Telephone-(See listing 3)

...Mildred, would you get that?...

The telephone bell is actually just repeated invocations of the percussive sound, using a high pitch and a short decay. Notice that the two sound registers are set at slightly different pitches. This creates the strident nature of this effect. The final percussive call uses a longer decay time, resulting in a fairly natural "lingering" sound. The apparently meaningless statement at line 10045 simply wastes some time between "rings." You will see this same type of delay in some of the other routines.

## 4. Alarm Bell-(See listing 4)

...Attention all hands! Secure for hyperwarp...

This is another application of the percussive effect, and is almost identical to the telephone bell. The main differences are that this effect uses a lower pitch and a slower repetition rate. One subtle modification to the percussion routine in both of these effects is the use of a larger value in testing for the end of the decay (notice the variable LM). This is another way to modify the decay time and may be preferable for fast action.

## 5. Explosion-(See listing 5)

...Hah! Got the little # @ \* % !...

The explosion effect is also based on the percussive generator, using "white" (actually "pink") noise instead of a musical tone. For more volume we use three sound registers simultaneously, and to heighten the realism each is given a slightly different pitch. Finally, we use three different rates of decay, the slowest for the lowest pitch. This gives the "rolling" effect of a really "big bang." Entering this subroutine with DUR set to zero will give a pretty fair imitation of a gunshot, since it's basically the same kind of sound.

## 6. Siren #1-(See listing 6)

...Is he after me?...

This routine produces the rising and falling wail characteristic of electro-

mechanical fire and police sirens. The inner loop in this subroutine (steps 10020 to 10035) generates either an increasing or decreasing pitch of constant amplitude. Each execution of the outer loop (steps 10015 to 10045) reverses the start, stop, and increment values. The delay is used again at step 10030 to waste a little time so that each execution of the loop takes about a second.

## 7. Siren #2-(See listing 7)

...Quickly, Henri! The Gendarmes...

This alternate siren effect, which I tend to think of as "European," is becoming more common in this country as well, as police and fire departments switch to purely electronic noisemakers. It is one of the simplest effects to create, requiring only alternating high and low pitches at constant volume. The wait loop is used again, at step 10025.

## 8. Ticking Clock-(See listing 8)

...You have ten seconds to guess the correct answer...

***If you have been programming without sound, you will be amazed at the improvement to be gained by its use in games and audio-visual presentations.***

The ticking of a clock (or bomb, heaven forbid) can be nicely simulated by repeated short bursts of white noise. Tone value eight, at a high pitch, serves this purpose. To get a tick-tock effect, two alternating values are used for the pitch parameter.

## 9. Klaxon-(See listing 9)

...RED ALERT! RED ALERT! Enemy sighted at...

Here, sound registers zero and one operate at slightly different pitches to generate a loud and strident blast, with sound register two filling in a buzzing effect. To add to the realism, one sound register is used at the beginning and end to build up to and decay from the main tone.

## 10. Whistle and Bomb-(See listing 10)

...Hit the deck!...

For this effect, the percussive explosion of example five is preceded by a convincing anticipatory whistle. Steps 10010 through 10030 create the whistle, which decreases in pitch while increasing in volume.

## 11. Steam Whistle-(See listing 11)

...All aboarrrrrd! Next Stop Pottsville...

A small amount of white noise from sound register zero in step 10025 adds a realistic hiss to this whistle variation. As in

the Klaxon effect, there is a brief build-up preceding the main sound, and a decay at the end.

## 12. Sawing Wood-(See listing 12)

...And now for something completely different...

This final effect, unrelated to the others, is an example of picking a sound at random and trying to imitate it on the Atari. For sawing wood, you need a buzzing sound... Subroutine 10065. You need to make it rise and fall in pitch as the blade moves... subroutine 10030. For better realism, you need two different pitches as the blade is pushed forward on the cutting stroke and then returned... statements 10015 and 10020.

It is hoped that these relatively simple examples will provide the motivation for Atari owners to get the most out of one of the built-in features of their computers. Other possible effects might include animal imitations, automobile sounds, factory noises, and on and on...the list of possibilities is truly unbounded.

If you have been programming without sound, you will be amazed at the improvement to be gained by its use in games and audio-visual presentations. Once you grow accustomed to this added dimension, it is certain that you will no longer be satisfied with a dull, mute computer.

The secret to success of the small personal computer lies in your creativity and imagination. Put them to work with Atari sound and see what develops. You can't go wrong!



LISTING 1: PERCUSSIVE SOUND GENERATOR

```
10000 REM PERCUSSIVE SOUND GEN
10002 REM ENTER W/2 PARAMETERS
10004 REM NTE=PITCH, 0-255
10006 REM DUR=LENGTH OF EFFECT, 0-10
10010 SOUND 1,5,8,6
10015 VOL=15: ICR=0.79+DUR/50
10020 SOUND 0,NTE,10,VOL
10025 SOUND 1,0,0,0
10030 VOL=VOL*ICR
10035 IF VOL>1 THEN 10020
10040 SOUND 0,0,0,0: RETURN
```

LISTING 2: DOORBELL

```
10000 REM DOORBELL
10002 REM NO ENTRY PARAMETERS
10010 NTE=105: DUR=7.5: GOSUB 10025
10015 NTE=132: DUR=8.5: GOSUB 10025
10020 SOUND 0,0,0,0: RETURN
10025 VOL=15: ICR=0.79+DUR/50
10030 SOUND 0,NTE,10,VOL
10035 VOL=VOL*ICR
10040 IF VOL>1 THEN 10030
10045 RETURN
```



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# Atari, continued...

## LISTING 3: TELEPHONE BELL

```

10000 REM TELEPHONE BELL
10002 REM ONE ENTRY PARAMETER
10004 REM TMS=# RINGS
10010 FOR XX=1 TO 35
10015 IR=0.3: LM=2: GOSUB 10055
10020 NEXT XX
10025 IR=0.9: LM=1: GOSUB 10055
10030 SOUND 0,0,0,0: SOUND 1,0,0,0
10035 TMS=TMS-1
10040 IF TMS<1 THEN RETURN
10045 FOR WT=1 TO 300: NEXT WT
10050 GOTO 10010
10055 VL=15
10060 SOUND 0,40,10,VL
10065 SOUND 1,42,10,VL
10070 VL=VL*IR
10075 IF VL>LM THEN 10060
10080 RETURN

```

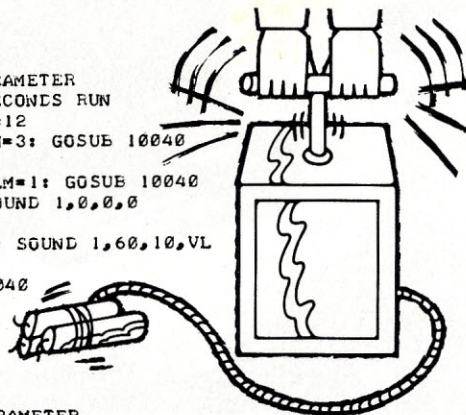


## LISTING 4: ALARM BELL

```

10000 REM ALARM BELL
10002 REM ONE ENTRY PARAMETER
10004 REM DUR=APPROX SECONDS RUN
10010 FOR TMS=1 TO DUR*12
10015 VL=15: IR=0.5: LM=3: GOSUB 10040
10020 NEXT TMS
10025 VL=10: IR=0.95: LM=1: GOSUB 10040
10030 SOUND 0,0,0,0: SOUND 1,0,0,0
10035 RETURN
10040 SOUND 0,53,10,VL: SOUND 1,60,10,VL
10045 VL=VL*IR
10050 IF VL>LM THEN 10040
10060 RETURN

```



## LISTING 5: EXPLOSION

```

10000 REM EXPLOSION
10002 REM ONE ENTRY PARAMETER
10004 REM DUR=LENGTH OF EFFECT, 0-10
10010 NTE=20: GOSUB 10025
10015 SOUND 1,0,0,0: SOUND 2,0,0,0
10020 RETURN
10025 SOUND 2,75,8,15
10030 ICR=0.79+DUR/100
10035 V1=15: V2=15: V3=15
10040 SOUND 0,NTE,8,V1
10045 SOUND 1,NTE+20,8,V2
10050 SOUND 2,NTE+50,8,V3
10055 V1=V1*ICR
10060 V2=V2*(ICR+0.05)
10065 V3=V3*(ICR+0.08)
10070 IF V3>1 THEN 10040
10075 SOUND 0,0,0,0: RETURN

```

## LISTING 6: AMERICAN SIREN

```

10000 REM SIREN 1
10002 REM ONE ENTRY PARAMETER
10004 REM DUR=APPROX SECONDS RUN
10010 LO=50: HI=35: STP=-1
10015 FOR TIM=1 TO DUR
10020 FOR NTE=LO TO HI STEP STP
10025 SOUND 0,NTE,10,14
10030 FOR WT=1 TO 20: NEXT WT
10035 NEXT NTE
10040 XX=LO: LO=HI: HI=XX: STP=-STP
10045 NEXT TIM
10050 SOUND 0,0,0,0: RETURN

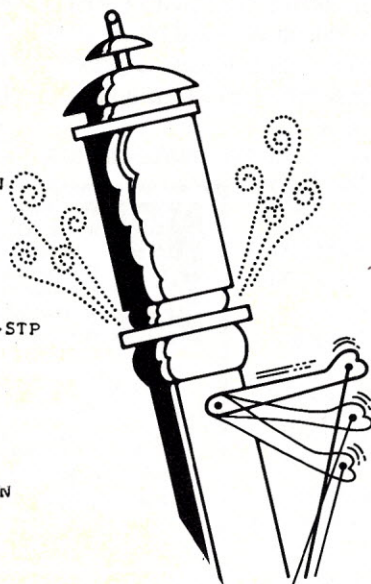
```

## LISTING 7: EUROPEAN SIREN

```

10000 REM SIREN 2
10002 REM ONE ENTRY PARAMETER
10004 REM DUR=APPROX SECONDS RUN
10010 LO=57: HI=45: NT=HI
10015 FOR TIM=0 TO DUR*2
10020 SOUND 0,NT,10,14
10025 FOR WT=1 TO 180: NEXT WT
10030 NT=LO: LO=HI: HI=NT
10035 NEXT TIM
10040 SOUND 0,0,0,0: RETURN

```



```

10000 REM TICKING CLOCK
10002 REM TWO ENTRY PARAMETERS
10004 REM SIZ=1(FST) TO 10(SLW)
10006 REM DUR=APPROX SECONDS AT SIZ 5
10010 TIC=SIZ*5: TOC=SIZ*10
10015 FOR TIM=1 TO DUR
10020 SOUND 0,TIC,8,12: GOSUB 10035
10025 SOUND 0,TOC,8,12: GOSUB 10035
10030 NEXT TIM: RETURN
10035 SOUND 0,0,0,0
10040 FOR WT=1 TO SIZ*34: NEXT WT
10045 RETURN

```

## LISTING 9: KLAXON

```

10000 REM KLAXON
10002 REM ONE ENTRY PARAMETER
10004 REM DUR=APPROX SECONDS RUN
10010 FOR TIM=1 TO DUR
10015 FOR NT=1 TO 10
10020 SOUND 0,100-NT,10,10
10025 NEXT NT
10030 SOUND 0,90,10,14
10035 SOUND 1,95,10,12
10040 SOUND 2,20,2,4
10045 FOR WT=1 TO 200: NEXT WT
10050 SOUND 1,0,0,0: SOUND 2,0,0,0
10055 FOR NT=1 TO 5
10060 SOUND 0,90+NT,10,8
10065 NEXT NT: SOUND 0,0,0,0
10070 FOR WT=1 TO 100: NEXT WT
10075 NEXT TIM: RETURN

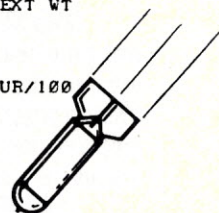
```

## LISTING 10: WHISTLE AND BOMB

```

10000 REM WHISTLE & BOMB
10002 REM ONE ENTRY PARAMETER
10004 REM DUR=LENGTH OF EFFECT
10010 V1=4: FOR NT=30 TO 75
10015 SOUND 0,NT,10,V1
10020 SOUND 1,NT+3,10,V1*0.7
10025 FOR WT=1 TO DUR*3: NEXT WT
10030 V1=V1*1.03: NEXT NT
10035 SOUND 2,35,8,12
10040 V1=15: V2=15: V3=15
10045 NT=DUR*5: ICR=0.79+DUR/100
10050 SOUND 0,NT,8,V1
10055 SOUND 1,NT+20,8,V2
10060 SOUND 2,NT+50,8,V3
10065 V1=V1*ICR
10070 V2=V2*(ICR+0.05)
10075 V3=V3*(ICR+0.08)
10080 IF V3>1 THEN 10050
10085 SOUND 0,0,0,0: SOUND 1,0,0,0
10090 SOUND 2,0,0,0: RETURN

```



## LISTING 11: STEAM WHISTLE

```

10000 REM STEAM WHISTLE
10002 REM ONE ENTRY PARAMETER
10004 REM DUR=APPROX SECONDS RUN
10010 FOR VL=2 TO 14
10015 SOUND 1,56,10,VL: SOUND 2,66,10,VL
10020 NEXT VL
10025 SOUND 1,55,10,14: SOUND 0,5,8,3
10030 FOR WT=1 TO DUR*400: NEXT WT
10035 SOUND 0,0,0,0
10040 FOR VL=14 TO 1 STEP -2
10045 SOUND 1,55,10,VL: SOUND 2,67,10,VL
10050 NEXT VL
10055 FOR WT=1 TO 25: NEXT WT
10060 SOUND 1,0,0,0: SOUND 2,0,0,0
10065 RETURN

```

## LISTING 12: SAWING WOOD

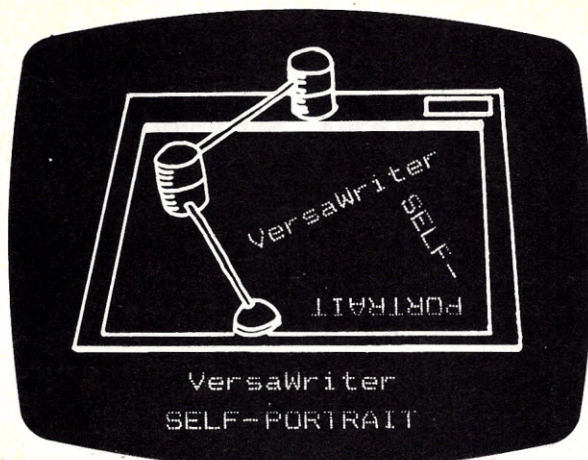
```

10000 REM SAWING WOOD
10002 REM ONE ENTRY PARAMETER
10004 REM DUR=APPROX SECONDS RUN
10010 FOR TMS=1 TO DUR
10015 ST=6: VL=12: GOSUB 10030
10020 ST=8: VL=8: GOSUB 10030
10025 NEXT TMS: RETURN
10030 FOR NT=ST+5 TO ST STEP -1
10035 GOSUB 10065: NEXT NT
10040 FOR NT=ST TO ST+5
10045 GOSUB 10065: NEXT NT
10050 SOUND 0,0,0,0: SOUND 1,0,0,0
10055 FOR WT=1 TO 25: NEXT WT
10060 RETURN
10065 SOUND 0,NT,2,VL
10070 SOUND 1,NT,8,VL*0.7
10075 WT=(WT/5)*5: RETURN

```



## PRICE BREAKTHROUGH



*We have used the VersaWriter to draw a picture of itself. Text may be added in any size or direction.*

# VersaWriter

## High-Resolution Color Graphics for Apple II or Apple II Plus

The VersaWriter graphics tablet lets you create multicolor graphics and drawings with your Apple computer. It compares in quality to graphic bit pads and digitizers costing three times more money.

VersaWriter is a digitizer and software package which presents a new approach to hi-res graphics. It consists of a mylar plotting board with a clear plastic overlay. Attached to this board is the drawing arm, which has a magnifying lens with a crosshairs at its end. You simply place any graph, picture or drawing (up to 8½" x 11") under the plastic overlay and "trace" it with the drawing arm. As you trace the drawing appears on the video screen.

The superior software of the VersaWriter enables you to do much more than just trace. Immediate commands include: color choice, brush size (the width of the drawing line), fill figure with color, draw a straight line between two points, use a different scale for drawing (.25 to 4), edit, erase, smothering factor (rounds off the rough edges as you draw), store picture on disk, and more.

One exceptional feature of the VersaWriter is the Shape Table function. You can take any picture,

or portion of a picture, and store it as a shape table. Then the table can be recalled from memory and placed on any part of the screen. You can change the size of the image, rotate it, add to it, etc. By incorporating a series of images into a single shape table, commonly used symbols can be easily inserted into a variety of different programs. VersaWriter software includes an Electronic Drawing program which is a shape table of common schematic symbols—this program will give you a good idea of what the shape table can do, as well as let you easily produce electronic or logic diagrams.

Other programs included in the software are: the Textwriter, with which text can be added to graphics (UPPER & lower case, choice of color, text size, direction of text, starting point of text). Area/Distance—this program allows you to calculate distances (or perimeters) by establishing a measuring unit (of your choice) and tracing the shape or map route with the drawing arm. Areas of figures are calculated in the same way—this includes irregular and open figures. A very simple calibration program is also on this software disk.

A second software disk contains

VersaWriter demonstration programs. For more advanced use of high-res graphics, there is a skeleton program which contains the guts of the VersaWriter. The VersaWriter is a sturdy peripheral device which plugs into the game paddles I/O port—the VersaWriter does not use up a card slot in the Apple computer. Also, the VersaWriter is not subject to the grounding problems and strong magnetic field problems of other, more expensive, hi-res graphic devices.

*VersaWriter requires an Apple II with Applesoft in ROM (or an Apple II Plus), Disk, and a least 32K of memory.*

*VersaWriter comes complete with 8½" x 11" drawing surface, plastic overlay and two disks of software. Price \$252.00 postpaid in continental USA. VersaWriter has a 90-day warranty on parts and labor.*

Credit card customers include card number and expiration date of your Visa, Mastercard or American Express card. No C.O.D.'s. Bankcard customers may order toll-free to:

**800-631-8112**

(In NJ call 201-540-0445)

Dealer Inquiries Invited.

## Peripherals Plus

119 Maple Ave., Morristown, NJ 07960

CIRCLE 239 ON READER SERVICE CARD



# The Many Faces of Elementary Computer Graphics

GRCH

```

1 PRINT " ARXGROU OUCHMARXGR"
2 PRINT " CHOMARXGROUCHOM UCHOMARXGROUCHOMA"
3 PRINT " MARXGROUCHOMARXGROU MARXGROUCHOMARXGROUCH"
4 PRINT " MARXGROUCHOMARXGROUC ARXGROUCHOMARXGROUCHOMARX"
5 PRINT " GROUCHOMARXGROUCHOMARX OUCHOMARXGROUCHOMARXGROUCHOMA"
6 PRINT " HOMARXGROUCHOMARXGRO OMARXGROUCHOMARXGROUCHOMARXGROU"
7 PRINT " RXGROUCHOMARXGROUCH GROUCHOMARXGROUCHOMARXGROUCHOMARX"
8 PRINT " XGROUCHOMARXGRO CHO XGROUCHOMARXGROUCHOMARXGRO"
9 PRINT " UCHOMARXGRO ROUCHOMARXGROUCHOM"
10 PRINT " ARXGROUCH OLMARXGROUCHOMARX"
11 PRINT " XGROUCHO RXGROUCHOMARXGROU"
12 PRINT " OUCHOM ROUCHOMARXGROUCHO"
13 PRINT " OMA CHOMARXGROUCHOMAR"
14 PRINT " XGROUCHOMARXGROUCH"
15 PRINT " CHOMARXGROUCHOMARX"
16 PRINT " ARXGROUCH GROUCHOMARXG CHOMARXGROUCHOMARX"
17 PRINT " HOMARXGROUCH UCHOMARXGROUCHOM OUCHOMARXGROUCHOMA"
18 PRINT " OMARXGROUCHMAARX MARXGROUCHOMARXGROU MARXGROUCHOMARXGRO"
19 PRINT " XGROUCHOMARXGROUCH ROUCHOMARXGROUCHOMA OUCHOMARXGROUCHOM"
20 PRINT " HO OUCHO ARXGR UCHOMARXG ARXGROUCHOMARXG"
21 PRINT " RXG MARXG UC RO ARXGROU UCHOMARXGROUCH ARXG"
22 PRINT " U GROUCHOMA HO GROUCHOMARX ARXGROUCHOMAR O HOM"
23 PRINT " A C MAR O X H C UCHOMARXGRO OM "
24 PRINT " RO"
25 PRINT " O ARX HOM C G R RXGROUCHO XGROU "
26 PRINT " OM"
27 PRINT " MA C RX R O ROU CHOMARX UCHOMARXG"
28 PRINT " OU UC HO ROUCHO GROUC MARXGROUCH"
29 PRINT " AR MA RXG RX HO GR ARXGROUCHOMA"
30 PRINT " UCH GR HOM OU X OM O HOMARXGR"
31 PRINT " XGROUCH ROUCHOM C RO M RXGROUCH"
32 PRINT " X RX CHOM MA ROUCHOMARXG"
33 PRINT " C G CHOM OU OMARXGRO H"
34 PRINT " RX CHOMAR R ARXGROUCHO XG"
35 PRINT " CH OUC ARXGROUCH HOMARX H"
36 PRINT " XG OMARXGROUCHOMARX XGROUCH XG"
37 PRINT " XGROUCHOMARXGROUCHOMARXGROUCH OM CHOM X "
38 PRINT " HOM"
39 PRINT " CHOMARXGROUCHOMARXGROUCHOMARX RO G C "
40 PRINT " R"
41 PRINT " RXGROUCHOMARXGROUCHOMARXGROUC M H AR "
42 PRINT " O"
43 PRINT " UCHOMARXGROUCHOMARXGROUCHOMA OUCHOM R X RO "
44 PRINT " G"
45 PRINT " RXGROUCHOMA ROUCHOMARXGR OM C O CHO "
46 PRINT " CH"
47 PRINT " MARXGR RXGR XG "
48 PRINT " R"
49 PRINT " XGROUC GR OM OM "
50 PRINT " OU"
51 PRINT " OUCHOM CH RO M"
52 PRINT " XGRO AR MA"
53 PRINT " M O HOM"
54 PRINT " M RO"
55 PRINT " ROUCHOM"
56 PRINT " M"
57 PRINT " GR"
58 PRINT " CH"
59 PRINT " AR"
60 PRINT " RO"
61 PRINT " HO"
62 PRINT " ARX"
63 PRINT " GRO"
64 PRINT " H"
65 PRINT " X"
66 PRINT " CH"
67 PRINT " XG"
68 PRINT " H"
69 PRINT " X"
70 PRINT " GROUCHOMARXGROUCHOMARXGROUCHOMARXGR"
71 PRINT " HOMARXGROUCHOMARXGROUCHOMARXGROUCHO"
72 PRINT " XGROUCHOMARXGROUCHOMARXGROUCHOMARXG"
73 PRINT " CHOMARXGROUCHOMARXGROUCHOMARXGROUCH"
74 PRINT " RXGROUCHOMARXGROUCHOMARXGROUCHOMARX"
75 PRINT " END"

```

Lynn Schwandt

LEN  
02391 WORDS = 10 RECORDS. 00518 RECORDS USED OF 00550 PERMITTED.

Lynn Schwandt, University of Northern Iowa, Cedar  
Falls, IA 50613.



```

1 DIM S$(71),G$(83),L$(73)
2 S$=""
3 FOR L=1 TO 64
4 R=INT(RND(0)*10)
5 G$="GROUCHOMARXGROUCHOMARXGROUCHOMARXGROUCHOMARXGROUCHOMARXGROUCHOMARXGROUCH"
6 L$(1,73)=G$(1+R,73+R)
7 READ B
8 READ E
9 IF E=0 THEN 14
10 L$(B,E)=S$(B,E)
11 IF L#49 THEN 7
12 L$(7,13)="GROUCHO"
13 GOTO 7
14 PRINT L$(1,B-1)
15 NEXT L
16 DATA 1,19,27,35,46,0,1,11,27,32,50,0,1,7,27,29,51,0,1,4,25,27,53,0
17 DATA 1,1,24,25,55,0,1,1,22,24,56,0,1,9,24,58,0,15,27,31,33,60,0,12,42
18 DATA 61,0,1,1,11,42,61,0,1,1,10,44,62,0,1,2,9,45,63,0,1,4,8,46,64,0
19 DATA 1,46,65,0,1,29,39,46,65,0,1,10,16,27,40,46,65,0,1,5,18,25,42
20 DATA 46,65,0,1,1,18,24,44,46,65,0,18,24,44,47,65,0,1,1,4,9,15,26,32
21 DATA 32,42,48,64,0,4,9,15,16,19,25,28,32,40,49,64,65,70,0,2,8,18,24
22 DATA 27,31,43,49,63,65,67,68,72,0,2,7,9,10,14,16,18,24,26,30,32,40,42
23 DATA 50,62,64,67,70,73,0,2,6,10,14,18,24,26,31,33,40,42,51,61,63,69
24 DATA 70,73,0,3,8,10,13,16,24,26,32,34,38,42,52,60,62,72,0,1,1,4,13,15
25 DATA 24,27,37,40,44,51,54,60,61,71,0,1,2,5,12,15,25,29,36,39,43,46,49
26 DATA 52,57,70,0,1,3,7,11,14,27,31,35,38,43,45,50,53,57,59,60,69,0
27 DATA 1,5,13,29,37,43,45,51,54,57,59,68,0,1,11,13,43,46,52,55,57,69,0
28 DATA 1,11,13,29,31,44,49,53,56,57,66,67,69,0,1,11,14,28,35,47,49,54
29 DATA 65,67,70,0,1,12,15,21,25,27,36,47,49,57,64,68,70,0,1,13,16,20
30 DATA 37,47,50,57,65,68,71,0,1,8,38,48,51,57,62,63,65,69,73,0,1,8,38,49
31 DATA 52,59,61,63,65,71,73,0,1,8,38,50
32 DATA 52,59,61,62,65,71,73,0,1,8,37,43,50,50,52,59,61,61,64,71,73,0
33 DATA 1,9,21,23,36,42,45,48,50,50,52,59,63,70,73,0,1,38,45,48,53,60
34 DATA 63,70,72,0,1,22,29,37,40,43,46,51,54,69,72,0,1,20,27,36,39,44
35 DATA 47,69,71,0,1,23,28,35,38,45,48,68,71,0,1,26,28,35,37,38,42,68
36 DATA 70,0,1,35,37,40,43,67,70,0,1,35,43,66,69,0,1,36,38,65,68,0
37 DATA 1,35,38,65,68,0,1,34,37,64,67,0,1,33,36,64,66,0,1,32,35,63,66,0
38 DATA 1,31,34,63,65,0,1,29,33,60,65,0,1,27,31,55,62,0,1,27,29,53,57,0
39 DATA 1,27,29,52,55,0,1,27,30,51,54,0,1,28,31,50,53,0,1,29,31,49,52,0
40 DATA 1,29,31,49,51,0,1,25,61,0,1,25,61,0,1,25,61,0,1,25,61,0,1,25,61,0
41 END

```

LEN  
01975 WORDS = 08 RECORDS. 00518 RECORDS USED OF 00550 PERMITTED.

There is an abundance of programs that will produce computer pictures on the hard-copy terminal. Students at all levels of ability and accomplishment find some degree of fascination in obtaining copies of these programs so that they can demonstrate to less knowledgeable persons the power of the computer. Students at the Price Laboratory School are no different and computer produced "art work" is generated by nearly every student at one time or another.

One of the advantages of computer art is that computer novices often are drawn to their first computer experiences this way. Then, as the novelty wears off, they often develop a desire to learn about programming.

When students were informed that computer art would have to use less disk-space, they were faced with the option of producing more efficient programs or losing some of their favorite art programs. Lee Potter, a high-school senior in one semester programming course, accepted the challenge as a special project.

The programs demonstrate two step solution generated by Lee. GRCH, the first program, was the starting point.

## A one-hour LP record of eight synthesizers may change your views about computer music forever

# Binary Beatles

by David Ahl

Computer music. Who needs it? It's mostly boring beep, beep, beeps or wildly modern stuff. It's certainly nothing you'd want to listen to more than once. That's what I thought about computer music and most of my friends agreed.

In 1978 I entered Yankee Doodle Dandy into my Software Technology system just to be different. Dick Moberg heard of it and asked me to perform in the Philadelphia Computer Music Festival. I agreed expecting to be the only one with something out of the ordinary. I was wrong.

### Computer Accompanist

Nine individuals and groups performed in the festival. There were the usual Bach pieces but even they were different. Gooitzen van der Wal performed the last movement of the 2nd Bach Suite in a unique way. He played the flute solo while using the computer as accompaniment.

Then Dorothy Siegel did the same thing, playing the clarinet solo part of Wanhals's Sonata in b flat. The audience went wild.

Hal Chamberlin played Bach's Tocatta and Fugue in d minor. But also with a difference. He used a large computer before hand to "compute" the waveform of every

instrument playing every note. It took one hour of computation time for each two minutes of playback time. The result could hardly be distinguished from the organ in the Hapsburg Cathedral.

Don Schertz had a home brewed synthesizer truly mounted on a breadboard that allowed him to control 25 parameters of each note. It produced spectacular sounds in his arrangement of Red Wing.

### Singing Computer

In 1962, D.H. Van Lenten at Bell Laboratories produced the first talking computer. Bell engineers taught it to recite the soliloquy from Hamlet. Then they went one step further and taught it to sing Daisy both alone and accompanied by another computer. This was also performed at the festival.

Yes, the Beatles were represented. Andrew Molda played Hey Jude on his COSMAC VIP system with a program called PIN-8 (Play it Now).

### Superb Quality Recording

All these pieces and twelve others were recorded with broadcast quality equipment. Because of audience noise, eight were re-recorded later in a studio. We then took these tapes to Tru-Tone, a top recording

studio and cut a lacquer master. It was a long session since the recording engineers insisted upon analyzing the sound from every source and setting up the equalization curves accordingly. It took over 12 hours to produce a one-hour lacquer master.

Finished recordings were then pressed on top-quality vinyl and inserted into liners and record jackets. These were then shrink wrapped in plastic for maximum protection. We guarantee that every LP record is free from defects or we will replace it free of charge.

The extensive descriptions of each of the eight synthesizers and the festival would not all fit on the jacket so we've included an extra sheet with each record. This entire package is mailed in a protective corrugated package to insure that it reaches you in mint condition. The cost is a modest \$6.00 postpaid in the U.S. and \$7.00 foreign. Send order with payment or Visa, MasterCard or American Express number to Creative Computing, Morris Plains, NJ 07950.

This LP record contains one hour of eight computer music synthesizers that you'll listen to over and over again. Send in your order today at no risk whatsoever.

## creative computing

Morris Plains, NJ 07950  
Toll-free 800-631-8112  
(In NJ 201-540-0445)



## Faces, continued...

GRCH is just a series of PRINT statements and consumes ten records of storage on the HP-2000. Programs of this type to produce ten different pictures would require one hundred records of disk storage. The problem was complicated by the desire to use the letters "GROUCHOMARX-GROUCHOMAR..." repeatedly to "sketch" the picture.

A big disadvantage is that the usual computer program for a picture consists of a number of print statements. This type of program requires little imagination, almost no programming skill and consumes a large amount of storage. Storage requirements are a particular problem when the shared-time system disk space is already utilized at 95% of capacity, and funds are unavailable for additional disk space.

The first partial solution, GRO2, involved using a character string of the repeated characters. `G$="GROUCHOMARX-GROUCHOMARX..."`. A second character string `S$` was loaded with all blanks. A third character string, `L$`, was built for each line to be printed. This was done by loading `L$` with characters from `G$` and then reading data to obtain the starting and ending points of the blanks that were required. The names `G$`, `S$`, `L$` were chosen to represent GROUCH, SKIP and LINE respectively.

To provide variety, a random starting point was chosen in G\$ before filling L\$. Then beginning and ending coordinates for each blank space are read one pair at a time from the data. If the ending coordinate is zero, the final blanks are loaded into L\$ and the line is printed. Otherwise another pair of coordinates is read and the blanks substituted in L\$ until the ending coordinate is zero.

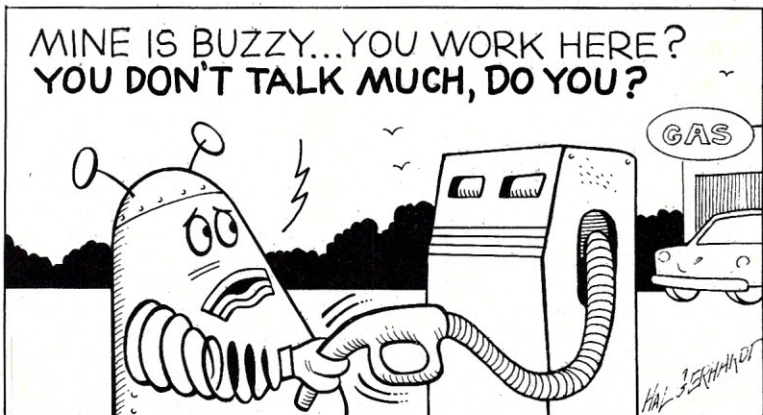
This first step was a decided improvement. GRO2 uses only eight records of storage as opposed to ten for GRCH. Lee was disappointed though. He had thought that the savings would be greater. The desire for a still more efficient storage approach led to the program GRO3 which uses

GR02

[illegible]

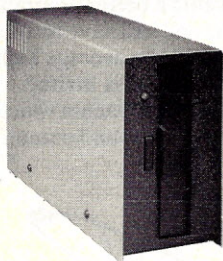
## Buzzy

Hal Gerhardt





# WE WILL NOT BE UNDERSOLD



## DISK DRIVES

**\$314**

40 track, 102K Bytes. Includes power supply and TRS-80\* compatible silver enclosure. Ready to plug-in and run the moment you receive it. Can be intermixed with each other and Radio Shack drive on same cable. 90 day warranty. One year on power supply. Available for 220 Vac (50 Hz) operation. **External card edge included.**

### FOR TRS-80\*

CCI-100	5 1/4", 40 Track (102K Bytes) for Model I	<b>\$314</b>
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CCI-800	8" Drive for Model II (1/2 Meg Bytes)	<b>\$795</b>

### For Zenith Z89

CCI-189	5 1/4", 40 Track (102K Bytes) add-on drive	<b>\$394</b>
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## DISKETTES — Box of 10 (5 1/4") — with plastic library case

Maxell	<b>\$30</b>	BASF or Verbatim	<b>\$24</b>
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**CLEAR PLASTIC CASE** — Holds 50 diskettes

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## DISK OPERATING SYSTEMS

PATCHPAK #4 by Percom Data		<b>\$ 8.95</b>
CP/M* for Model I, Zenith	<b>\$145</b>	• for Model II, Altos <b>\$169.00</b>
NEWDOS Plus		<b>40track \$ 79.00</b>
NEWDOS 80		<b>\$135.00</b>

## COMPLETE SYSTEMS

ALTOS 64K, DD, SS, 2-Drive, 1MB	ACS 8000-2	<b>\$3395</b>
APPLE 16K		<b>\$969</b>
TRS-80* Model II-64K		<b>\$3499</b>
TRS-80* Model III - 16K		<b>\$899</b>
TRS-80* Expansion Interface		<b>\$249</b>
ZENITH Z89, 48K all-in-one computer		<b>\$2440</b>
ZENITH Z19		<b>\$735</b>
TELEVIDEO 920C		<b>\$748</b>
ATARI 400 \$489	ATARI 800	<b>\$747</b>
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MATTEL INTELLIVISION		<b>\$229</b>

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LEEDEX 12" B & W Video 100	<b>\$129</b>
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SANYO 12" Green Screen DM5112	<b>\$215</b>
SANYO 13" Color DMC6013	<b>\$375</b>
APF 9" B & W TVM-10	<b>\$139</b>

## TELECOMMUNICATIONS

LIVERMORE STAR MODEM 2-year guarantee	<b>\$145</b>
CAT MODEM Works same as Radio Shack Telephone Interface II	<b>\$148</b>
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## COMMUNICATIONS SOFTWARE

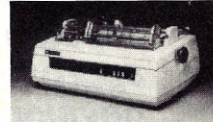
CCI-TELNET VERSION 5: A communication package which enables microcomputer users to communicate both with large mainframes and other microcomputers. Completely CP/M compatible. Multiple communication protocols supported. **\$149**

INTELLIGENT TERMINAL SYSTEM ST-80 III: Enables a TRS-80\* to act as a dial-up terminal on any time sharing network. **\$139**

## 16K MEMORY UPGRADE KITS 2 for \$65 **\$35**

200 ns for TRS-80\*, Apple II, (specify): **Jumpers \$2.50**

## PRINTERS



### NEC Spinwriter

#### Letter Quality High Speed Printer

Includes TRS-80\* interface software, quick change print fonts, 55 cps, bidirectional, high resolution plotting, graphing, proportional spacing: R.O. **\$2395**

R.O. with Tractor Feed **\$2575** KSR with Tractor Feed **\$2950**

C.I.TOH Starwriter, 25 CPS, daisy wheel printer **\$1895**

C.I.TOH Starwriter II, 45 CPS, daisy wheel printer **\$2195**

Letter quality printers. Use up to 15" paper. 1 year warranty on parts. 3 months on labor. Proportional spacing and bidirectional printing. Same as VISTA V300.

**779 CENTRONICS TRACTOR FEED PRINTER \$969**

Same as Radio Shack line printer I

**737 CENTRONICS FRICTION & PIN FEED PRINTER \$795**

n x 9 proportional and 7 x 8 mono spacing.

Same as Radio Shack line printer IV

**730 CENTRONICS FRICTION & PIN FEED PRINTER \$595**

7 x 7 matrix Same as Radio Shack line printer II

**P1 CENTRONICS PRINTER Same as Radio Shack quick printer \$269**

**PAPER TIGER (IP445) \$699**

(IP440) Includes 2K buffer and graphics option

(IP460) Bidirectional, 160 cps, graphics and 2K buffer **\$879**

**\$1075**

**TI-810** Faster than Radio Shack line printer III. Parallel and

serial w/TRS-80\* interface software w/u + 1 case & paper tray

Compressed print, vertical form control **\$1589**

**OKIDATA Microline 80** Friction and pin feed **\$1865**

Tractor Feed, friction, and pin feed **\$545**

**Microline 82** Bidirectional, friction and pin feed **\$645**

**Microline 83** Bidirectional, 120 cps, uses up to 15" paper **\$745**

**EATON LRC 7000 + 64 columns, plain paper \$1050**

**ANADIX DP-9500/01 \$1350 DP-8000 \$289 \$795**

## ACCESSORIES

**HEAD CLEANING DISKETTE:** Cleans drive Read/Write head in 30 seconds. Specify 5 1/4" or 8". **\$20 ea/\$45 for 3**

**FLOPPY SAVER:** Protection for center holes of 5 1/4" floppy disks. Installation tools and rings for 25 diskettes. **\$11.95**

**Re-orders of rings only \$ 6.95**

**EXTERNAL DATA SEPARATOR:** Eliminates data separation problems (crc). Improves reliability. This plug in unit comes fully assembled and tested. **\$ 29.95**

**Z-80 SOFTCARD:** Your key to software expansion. The plug-in Z-80 Softcard transforms your Apple into a Z-80 while keeping all the benefits of the 6502. Comes with CP/M in two disk format, MBASIC and GBASIC, full documentation and utility programs. **\$339**

**RF MODULATOR:** Adapts video to TV **\$ 35.00**

**TRS-80 & OTHER MYSTERIES \$ 18.95**

**NEC SPINWRITER THIMBLE \$11.95 RIBBON \$ 6.00**

**CCS CARDS:** Parallel or serial printer interface cards **\$115.00**

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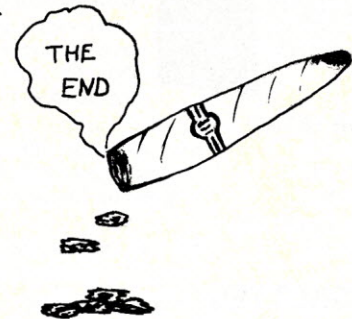


“packed” data to store the information about where the spaces should be.

While GRO3 requires only few records of storage, there is probably a more efficient

***The purpose was not to develop the best approach, but to develop a better program than the previous one.***

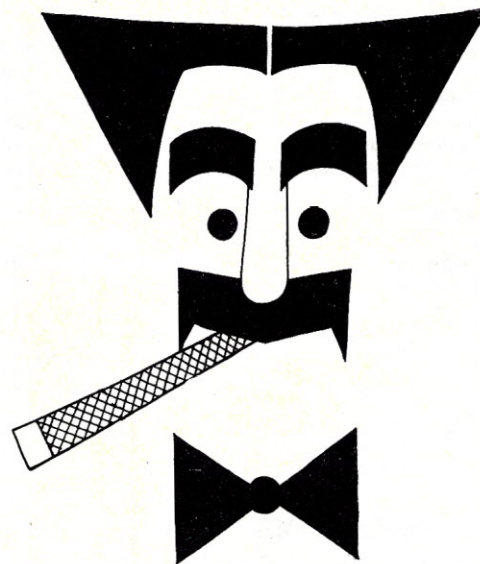
approach than the one illustrated in GRO3. The purpose was not to develop the best approach, but to develop a better program than the previous one and still have results which are understandable by average high school students. The reader is invited to generate and share other approaches which are more efficient but yet understandable.



```

1 DIM S[L71],G*[E83],L*[E73],A[E20]
2 S$=""
3 FOR L=1 TO 65
4 R=INT(RND(O)*10)
5 G$="GROUCHOMARXGROUCHOMARXGROUCHOMARXGROUCHOMARXGROUCHOMARXGROUCHO*"
6 L$[1,73]=G$[1+R,73+R]
7 X=1
8 READ N
9 IF N=0 THEN 22
10 IF N<0 THEN 24
11 IF X#1 THEN 13
12 A[I]=1
13 D=10000
14 FOR U=1 TO 3
15 X=X+1
16 AC[X]=INT(N/D)
17 IF AC[X]=0 THEN 27
18 N=N-INT(N/D)*D
19 D=D/100
20 NEXT U
21 GOTO 8
22 AC[X+1]=0
23 GOTO 27
24 X=0
25 N=-N
26 GOTO 13
27 FOR I=1 TO X STEP 2
28 B=A[I]
29 E=A[I+1]
30 IF E=0 THEN 35
31 L$[B,E]=S[B,E]
32 IF L$[49] THEN 34
33 L$[7,13]="GROUCHO"
34 NEXT I
35 PRINT L$[1,B]
36 NEXT L
37 DATA 192735.,460000.,112732.,500000.,72729.,510000.,42527.,530000.,12425
38 DATA 550000.,12224,560000.,-192458.,0,-152731.,335800.,-124259.,0,11142
39 DATA 600000.,11044,610000.,20945,610000.,40846.,630000.,466400.,293946.
40 DATA 640000.,101627.,404664.,0,51825.,424664.,0,11824,444664.,0,-182444.
41 DATA 476400.,10409,152632.,324248.,630000.,-40915.,161925.,283240.,496465.
42 DATA 690000.,-20818,242731.,434963.,656769.,710000.,-20709,101416.,182426.
43 DATA 303240.,425062.,646770.,720000.,-20610,141824.,263133.,404251.,616368.
44 DATA 717200.,-30810,131624.,263234.,384252.,606271.,0,10413,152427.,374044.
45 DATA 515460.,617000.,20512,152529.,363943.,464952.,576900.,30711,142731.
46 DATA 353843.,455053.,575960.,680000.,51329.,374345.,515457.,595967.,0,111343.
47 DATA 465255.,576800.,111329.,314449.,535657.,666768.,0,111428.,354749.
48 DATA 546567.,690000.,121521.,252736.,474957.,646869.,0,131620.,374750.
49 DATA 576568.,700000.,83848.,515762.,636569.,720000.,83849.,525961.
50 DATA 636571.,720000.,83850.,525961.,626571.,720000.,83743.
51 DATA 505052.,596161.,647172.,0,92123.,364245.,485050.,525963.,707200.,384548.
52 DATA 536063.,707100.,222937.,404346.,515469.,710000.,202736.,394447.,697000.
53 DATA 232835.,384548.,687000.,262835.,373842.,686900.,353740.,436769.,0
54 DATA 354366.,680000.,363865.,670000.,353865.,670000.,343764.,660000.
55 DATA 333664.,650000.,323563.,650000.,313463.,640000.,293360.,640000.
56 DATA 273155.,610000.,272953.,560000.,272952.,540000.,273051.,530000.
57 DATA 283150.,520000.,293149.,510000.,293149.,500000.,256000.,256000.
58 DATA 256000.,256000.,256000.
59 END

```

A stylized black and white graphic of Grocho Marx's face. He has large eyes, thick eyebrows, and a prominent mustache. He is wearing a dark bow tie and holding a cigar in his mouth. The background is plain white.

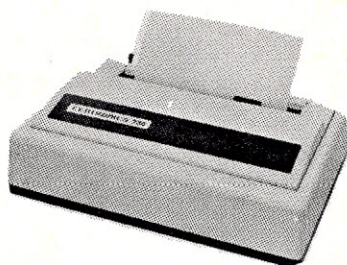


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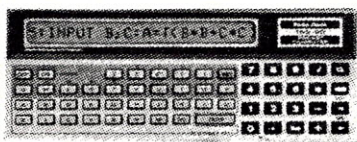
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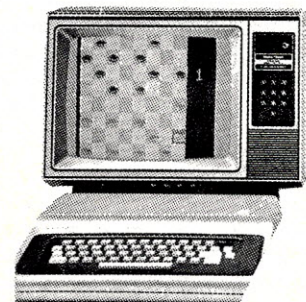
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# Hexagons and Ellipses the Easy Way

*Gordon Speer*

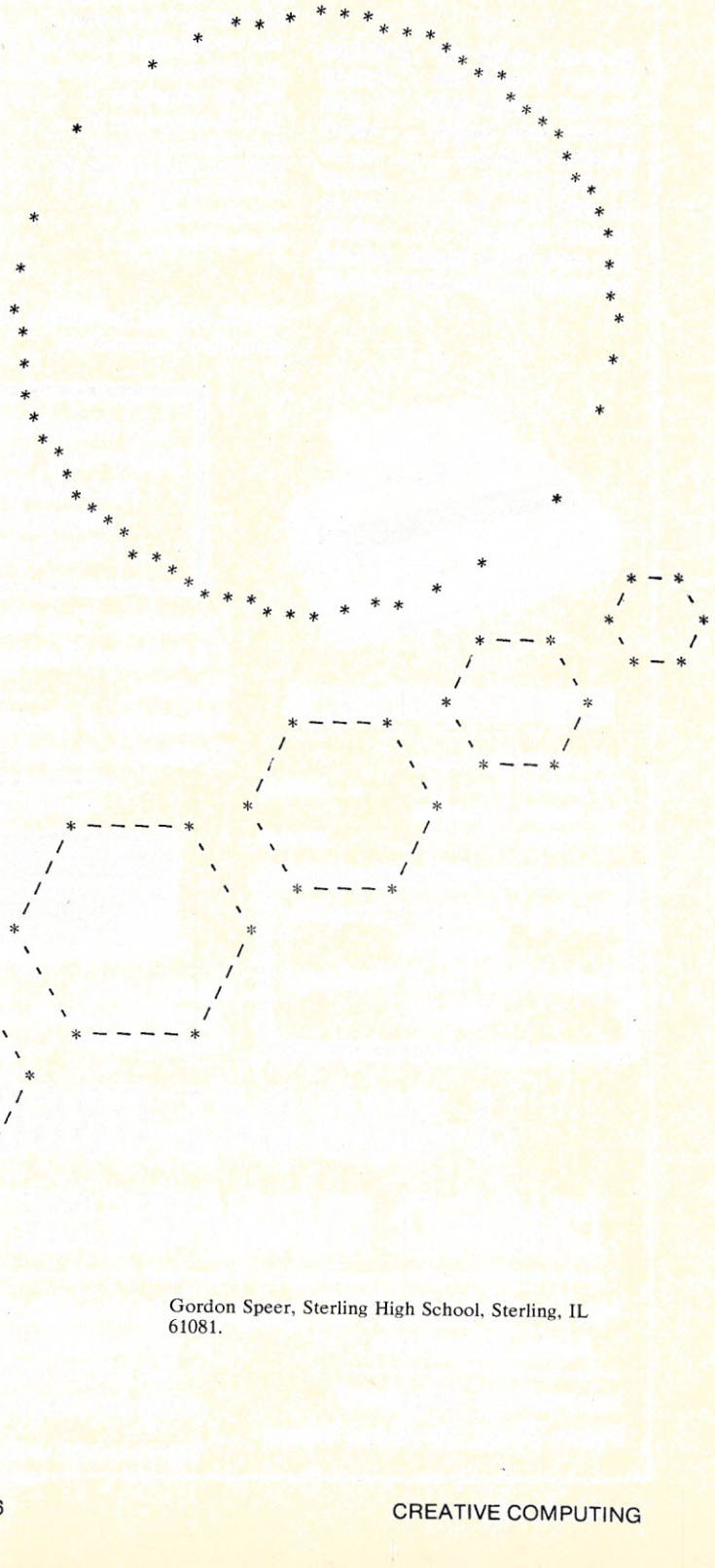
Here is proof, twice over, that graphics programs can be short, simple, and elegant. Listing #1 produces ellipses with any chosen major axis and any minor axis that has a value less than seven. The second listing (both programs are by Gordon Speer) produces a series of hexagons, each one larger than the last. Using the same approach, readers might wish to try producing other figures that can be printed in this manner. — DL

## LISTING 1

```
10 DIM M(2)
20 INPUT M(1),M(2)
30 LET A = 25 * (M(2) ^ 2)
40 LET B = 3 * (M(1))
50 FOR Y = B TO -B STEP -1
60 LET X = INT (SQR (ABS (A - (A * Y ^ 2) / B ^ 2)))
70 PRINT TAB (35 - X) "*" ; TAB (35 + X) "*"
80 NEXT Y
90 END
```

## LISTING 2

```
10 REMARKABLE HEXAGONS BY SPEER -- BENZENE RINGS ALA KEKULE
50 FOR S = 1 TO 10
60 PRINT TAB (34 - S) "*" ;
70 FOR N = 1 TO S
80 PRINT "-- " ;
90 NEXT N
100 PRINT "*"
105 LET Q = S
110 FOR N = 1 TO S
120 PRINT TAB (33 - Q) "/" ; TAB (37 + Q) "\"
130 LET Q = Q + 1
135 NEXT N
140 PRINT TAB (33 - 2 * S) "*" ; TAB (37 + 2 * S) "*"
145 LET Q = 2 * S - 1
150 FOR N = 1 TO S
160 PRINT TAB (33 - Q) "\" ; TAB (37 + Q) "/"
165 LET Q = Q - 1
170 NEXT N
190 PRINT TAB (34 - S) "*" ;
200 FOR N = 1 TO S
210 PRINT "-- " ;
215 NEXT N
220 PRINT "*"
230 PRINT
240 PRINT
250 NEXT S
999 END
```



Gordon Speer, Sterling High School, Sterling, IL 61081.





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**WARNING:** not for beginning Dunjonquest players! If you are new to these fascinating games, start out with "Temple of Apshai", "Morloc's Tower" or "Datestones of Ryn".

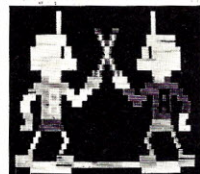
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## INVADERS FROM SPACE

By Carl Miller from Acorn

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INVADERS FROM SPACE offers variable game speed, enemy bomb frequency and accuracy, number of shots on screen and number of your bases. Move your base and simultaneously fire at the invaders -- which you cannot do in most other similar games. Full sound effects, incredible speed and action!

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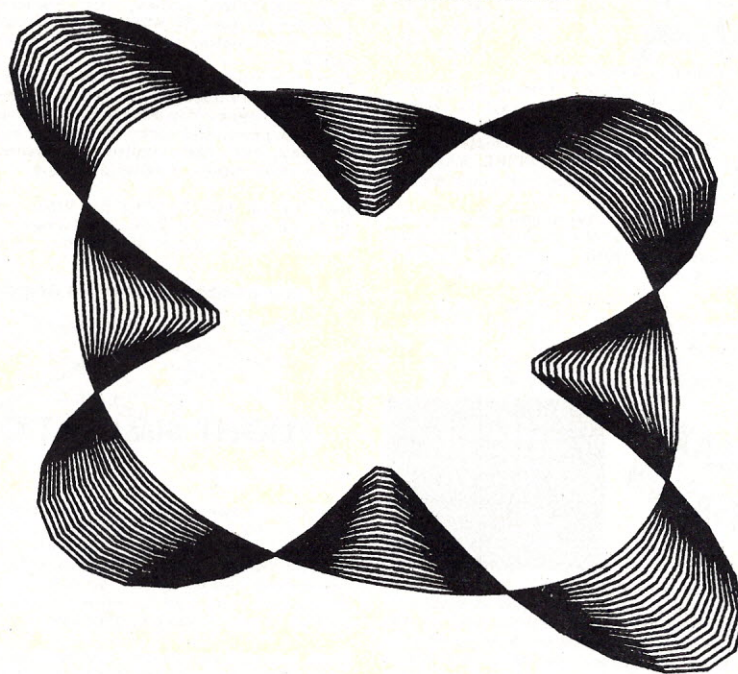
# Grapefruit Delight\*

\*and other surprises

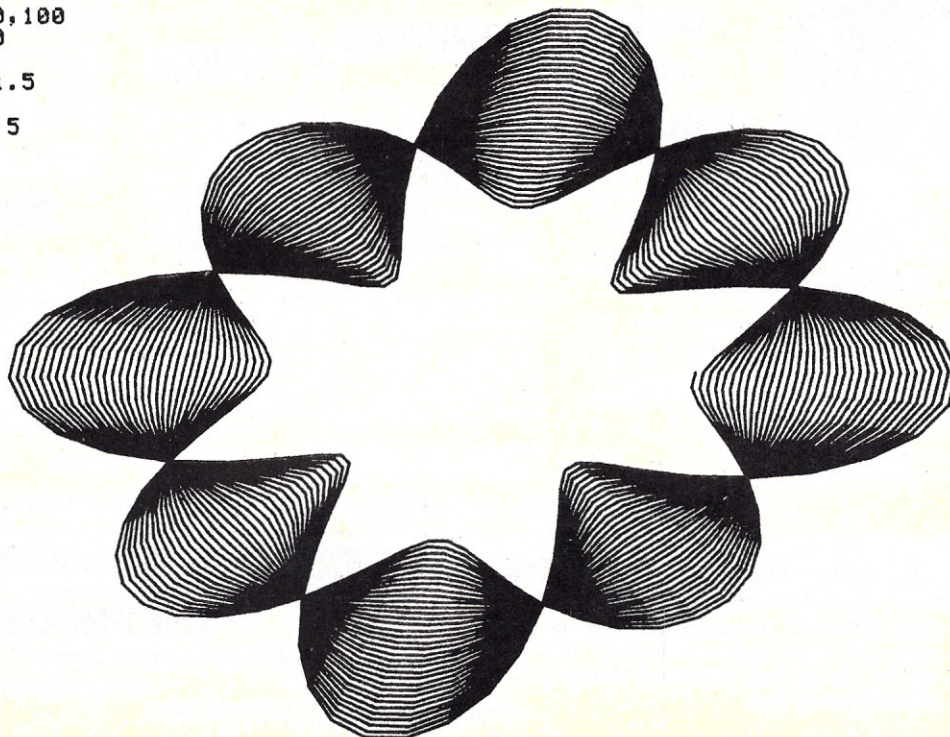
*Joe Jacobson*

The programs shown below, written for a Tektronix 4051, demonstrate an interesting approach to graphics. Each program produces a specific type of figure, but the results can vary widely depending on the input. As you can see, this method produces pleasing and surprising results. □

Joe Jacobson, 1602 Upland Ave., Jenkintown, PA 19046.



```
100 REM RING SINE
101 PRINT "B IS THE INITIAL AMPLITUDE; USE B=-30 OR B= 1.5"
102 PRINT "ENTER B"
103 INPUT B
105 SET DEGREES
106 WINDOW -100,100,-100,100
107 VIEWPORT 0,130,0,100
110 PAGE
117 FOR A=B TO 30 STEP 1.5
119 MOVE 60,0
120 FOR T=0 TO 360 STEP 5
130 R=60+A*SIN(4*T)
135 X=R*COS(T)
136 Y=R*SIN(T)
140 DRAW X,Y
150 NEXT T
160 IF A>=30 THEN 170
165 NEXT A
170 END
```

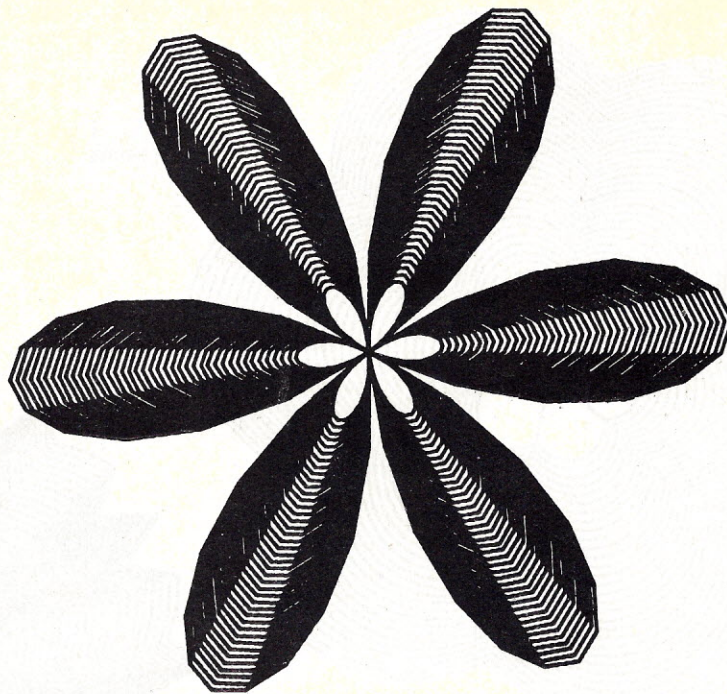




```

89 REM THREE-LEAF CLOVER
100 PAGE
109 SET DEGREES
110 WINDOW -500,500,-500,500
111 VIEWPORT 15,115,0,100
112 PAGE
113 PRINT "ENTER L"
114 INPUT L
115 PAGE
120 FOR B=100 TO 500 STEP 10
130 FOR A=0 TO 360 STEP 5
140 GOSUB 180
145 IF A>0 THEN 150
146 MOVE X,Y
147 GO TO 160
150 DRAW X,Y
160 NEXT A
170 NEXT B
180 R=B*ABS(SIN(L*A))
190 X=R*COS(A)
200 Y=R*SIN(A)
210 RETURN
220 END

```



```

89 REM GRAPEFRUIT DELIGHT
90 DIM R1(3)
100 PAGE
109 SET DEGREES
110 WINDOW -501,501,-501,501
111 VIEWPORT 15,115,0,100
112 PAGE
113 L=6
120 B=300
130 FOR A=0 TO 360 STEP 5
140 GOSUB 180
145 IF A>0 THEN 150
146 MOVE X,Y
147 GO TO 160
150 DRAW X,Y
160 NEXT A
175 GO TO 219
180 R=B*(1+0.1*ABS(SIN(L*A)))
190 X=R*COS(A)
200 Y=R*SIN(A)
210 RETURN
219 MOVE B/3,0
220 FOR A=0 TO 360 STEP 5
230 R=B/3*(1+0.1*ABS(SIN(1.5*A)))
240 X=R*COS(A)
250 Y=R*SIN(A)
255 DRAW X,Y
260 NEXT A
270 C=1.1*B+15
280 MOVE C,0
290 FOR A=0 TO 360 STEP 5
300 X=C*COS(A)
310 Y=C*SIN(A)
320 DRAW X,Y
330 NEXT A
340 R1(1)=B/3*(1+0.1*ABS(SIN(1.5*60)))
350 R1(2)=B/3*(1+0.1*ABS(SIN(1.5*30)))
360 R1(3)=B/3
370 A1=0
380 J=3
390 GOSUB 500
400 A1=60
410 J=1
420 GOSUB 500
430 A1=30
440 J=2
450 GOSUB 500
460 A1=90
470 J=2

```

```

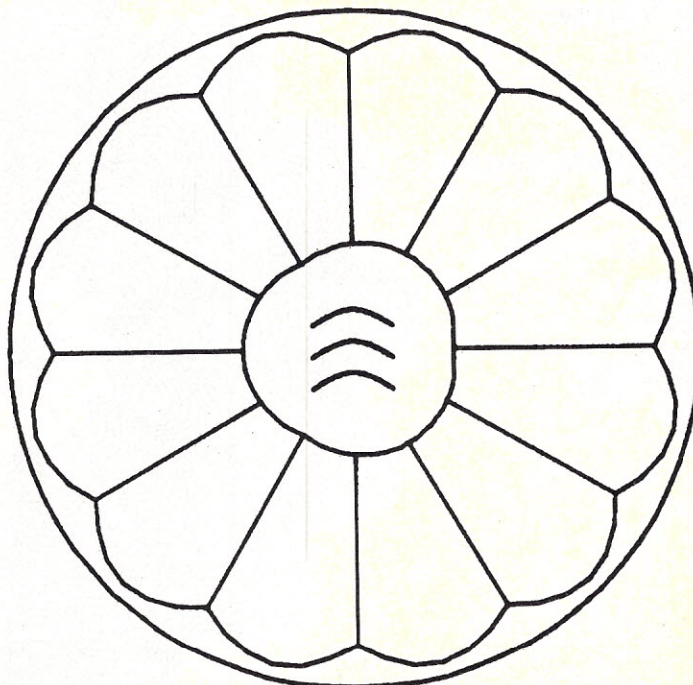
480 GOSUB 500
490 GO TO 600
500 FOR M=1 TO 3 STEP 1
510 A=A1+(M-1)*120
520 X=B*COS(A)
530 Y=B*SIN(A)
540 MOVE X,Y
550 X=R1(J)*COS(A)
560 Y=R1(J)*SIN(A)
570 DRAW X,Y
580 NEXT M
590 RETURN
600 WINDOW 0,180,-2.01,3.01
610 VIEWPORT 61,69,46,54

```

```

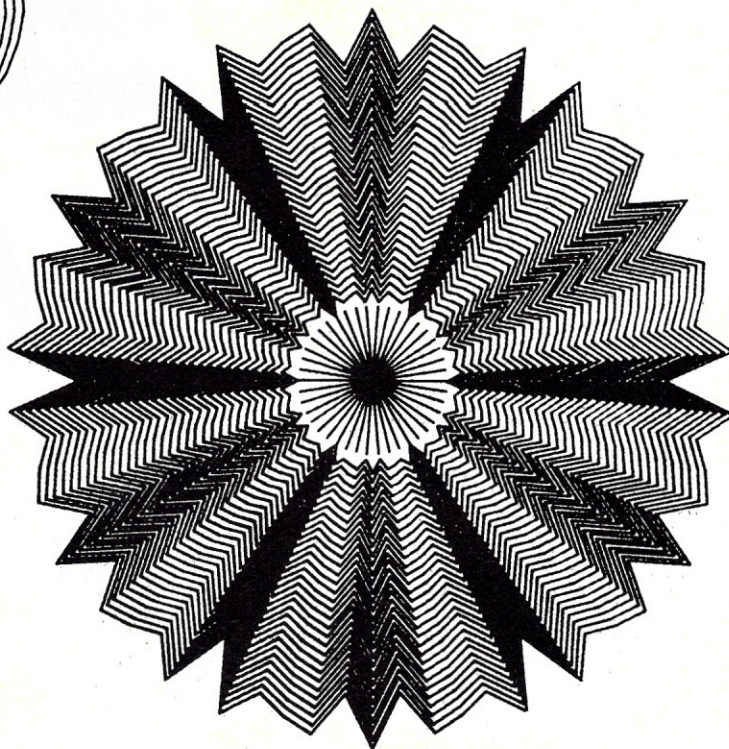
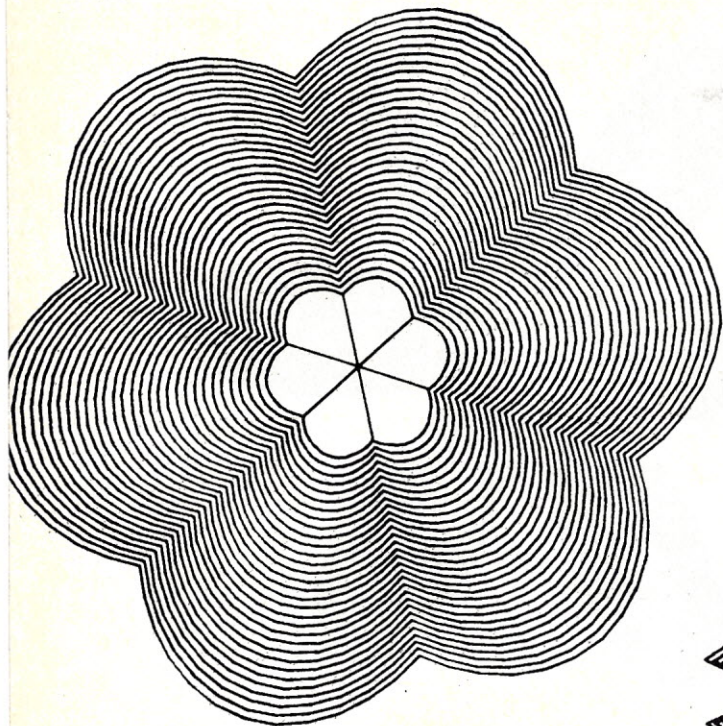
620 D=-2
630 GOSUB 690
640 D=0
650 GOSUB 690
660 D=2
670 GOSUB 690
680 GO TO 740
690 MOVE 0,D
695 FOR X=0 TO 180 STEP 2
700 Y=SIN(X)+D
710 DRAW X,Y
720 NEXT X
730 RETURN
740 END

```



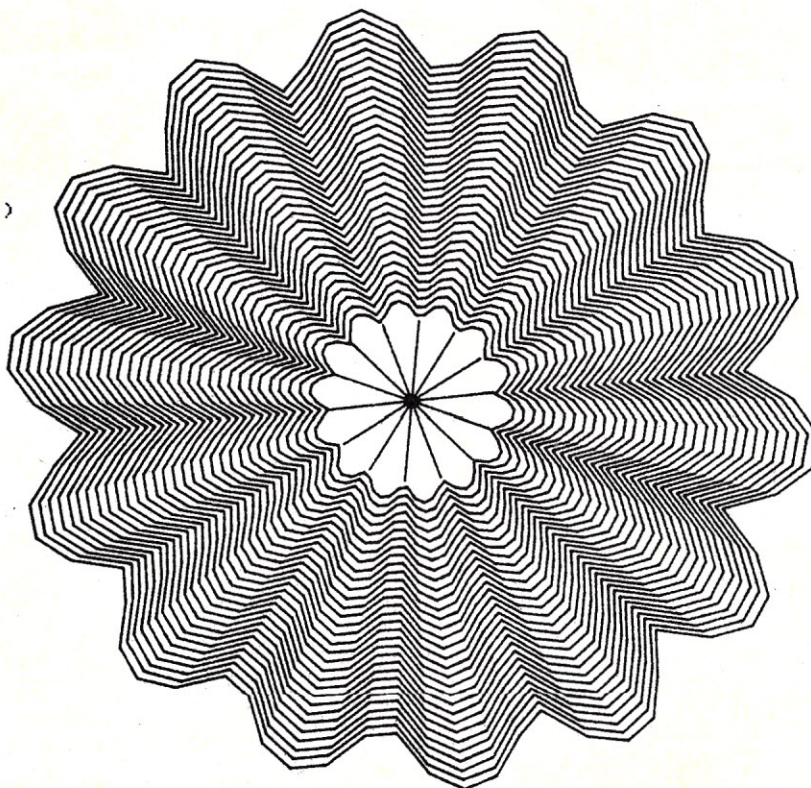
GRAPEFRUIT DELIGHT





```

89 REM FLUTED SCALLOPS
100 PAGE
109 SET DEGREES
110 WINDOW -501,501,-501,501
111 VIEWPORT 15,115,0,100
112 PAGE
113 PRINT "ENTER L"
114 INPUT L
115 PAGE
120 FOR B=100 TO 400 STEP 10
130 FOR A=0 TO 360 STEP 5
140 GOSUB 180
145 IF A>0 THEN 150
146 MOVE X,Y
147 GO TO 160
150 DRAW X,Y
160 NEXT A
170 NEXT B
175 GO TO 211
180 R=B*(1+0.25*ABS(SIN(L*A)))
190 X=R*COS(A)
200 Y=R*SIN(A)
210 RETURN
211 FOR N=0 TO L-1 STEP 1
212 R=100
213 T=N*(180/L)
214 X=R*COS(T)
215 Y=R*SIN(T)
216 MOVE X,Y
217 X=R*COS(T+180)
218 Y=R*SIN(T+180)
219 DRAW X,Y
220 NEXT N
221 END
    
```





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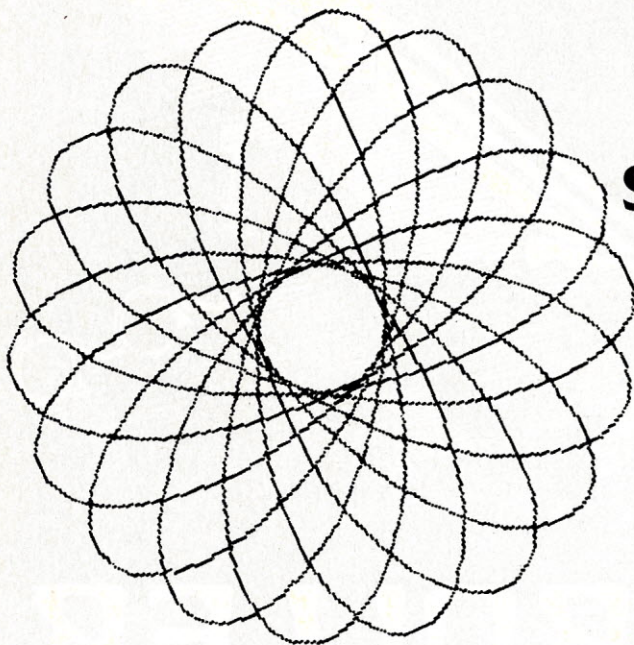
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# Spiro-Graph

**Brian Sietz**

## Introduction

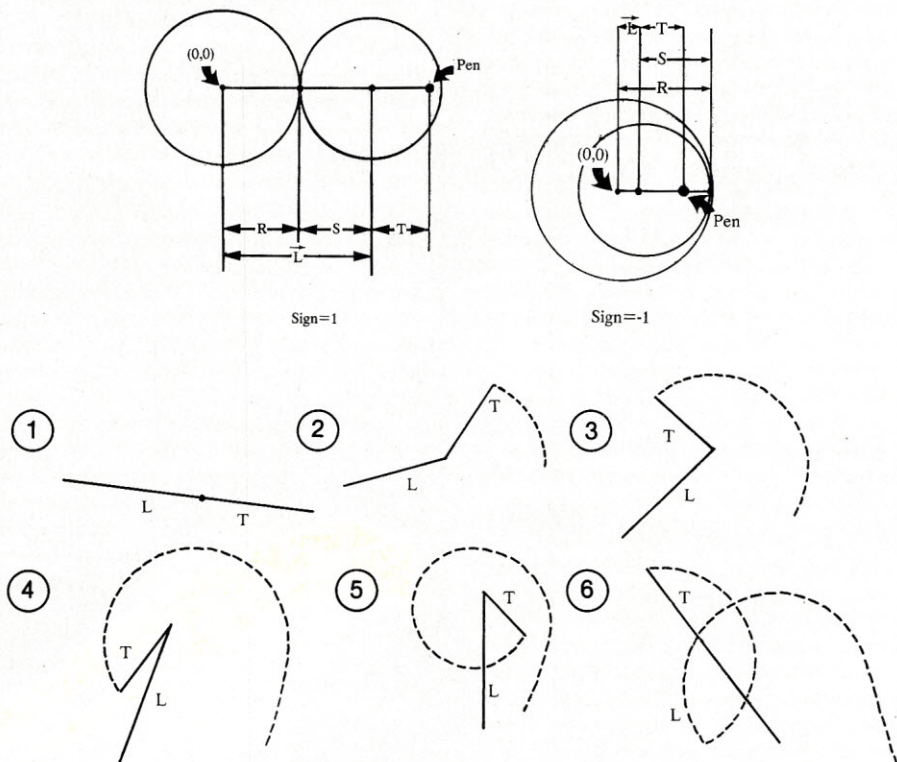
When I was younger, I remember making pretty designs with my spiro-graph toy. To make a design, I would take two wheels with gears around the outside and tack one into a piece of paper. The other wheel would either rotate outside or inside of the first wheel. The pen would be in a hole on the rotating wheel, and would leave a trail behind it as the wheel turned.

This program is designed around the same principle. There are four pieces of data which this program needs to run. These are R, S, T and Sign. R is the radius of the stationary circle, S is the radius of the moving circle, and T is the distance from the center of circle S to where the pen is placed. Sign will be either -1, meaning circle S is inside circle R, or 1, meaning that circle S is outside circle R.

## Theory

The theory is fairly simple. If you look at Fig. 1 where Sign = 1, you will see a vector L. The length of L is the distance between the center of circles, R and S. L is rotated about the origin, while another Vector T rotates around the end of L. Since the two don't rotate at the same rate, an interesting pattern is created. This can easily be seen in Fig. 2.

In order to save time during execution, I created an array S2 and C2 consisting of sines and cosines. This way, to take a sine or cosine of a number, you only need to execute a memory reference, rather than having the computer do the calculations.



## Operation

This program was written on a Hewlett Packard HP9845 desktop computer. It was simplified greatly in order to run on most micros. There are some odd statements that might have to be changed to run on your computer. Line 370 is to enter GRAPHICS mode, line 380 clears the Graphic memory and line 390 draws a

border on the screen. Line 440 assigns minimum and maximum for the X-Y coordinates and line 480 determines what portion of the maximum is to be displayed. Most other statements are standard Basic statements with standard variables. This program is made to run on a high resolution screen or a plotter. However, it is possible to modify it to run on lower resolution graphic computers. □



```

10 GOSUB 620
20 DIM S2(80),C2(80)
30 REM INITIALIZE S2 AND C2 ARRAYS
40 REM S2 ARRAY IS AN ARRAY OF SINES
50 REM C2 ARRAY IS AN ARRAY OF COSINES
60 T=80
70 D=2*PI/T
80 A=0
90 Q0=T/8
100 Q1=T/4
110 Q2=T/2
120 Q3=3*T/4
130 FOR X=0 TO 80
140 S2(X)=SIN(A)
150 C2(X)=COS(A)
160 C2(Q1-X)=S2(X)
170 S2(Q1-X)=C2(X)
180 U=X
190 FOR Y=1 TO 2
200 C2(U+Q1)=-S2(U)
210 S2(U+Q2)=-S2(U)
220 C2(U+Q3)=S2(U)
230 S2(U+Q1)=C2(U)
240 C2(U+Q2)=-C2(U)
250 S2(U+Q3)=-C2(U)
260 U=Q1-X
270 NEXT Y
280 A=A+D
290 NEXT X

```

```

300 DISP "SELECT R,S,T,SIGN";
310 INPUT R,S,T,S1
320 REM R IS THE RADIUS OF STATIONARY CIRCLE
330 REM S IS THE RADIUS OF THE MOVING CIRCLE
340 REM T2 IS THE DISTANCE FROM THE CENTER OF CIRCLE S TO THE PEN
350 REM IF S1=1 THEN CIRCLE S ROTATES OUTSIDE CIRCLE R
360 REM IF S1=-1 THEN CIRCLE S ROTATES INSIDE CIRCLE R
370 GRAPHICS
380 GCLEAR
390 FRAME
400 L=R-S1*S
410 REM L IS THE DISTANCE BETWEEN THE CENTERS OF CIRCLES R AND S
420 D1=-S1*R/S*D
430 T1=2*PI
440 SCALE -200,200,-200,200
450 X1=(L+T2)*1.1
460 REM X1 IS 10% LARGER THAN TOTAL RADIUS OF DESIGN
470 REM X1 IS USED TO AUTOMATICALLY SCALE THE DESIGN TO THE PAPER
480 SHOW -X1,X1,-X1, X1
490 PENUP
500 X=1
510 P=PI

```

```

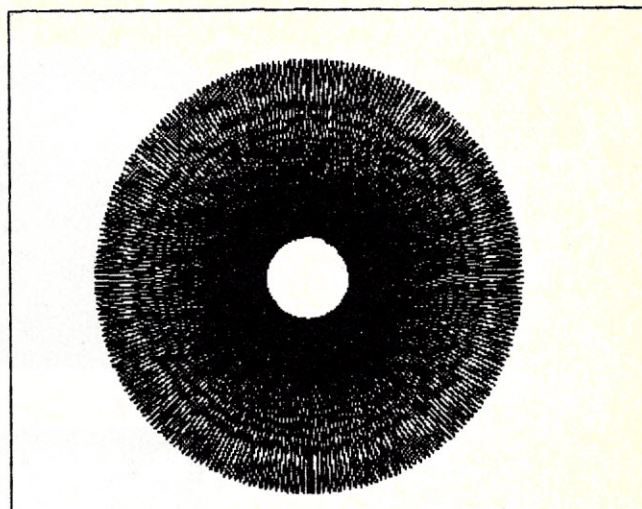
520 REM PLOTTING ROUTINE
530 PLOT L*C2(X)+T2+COS(P),L*S2(X)+T2*SIN(P)
540 P=P+D1
550 IF -S1*P>T1 THEN P=P+S1*T1
560 X=X+1
570 IF X<=T THEN 530
580 X=1
590 IF P<>-S1*PI THEN 530
600 PLOT L*C2(X)+T2+COS(P),L*S2(X)+T2*SIN(P)
610 END

```

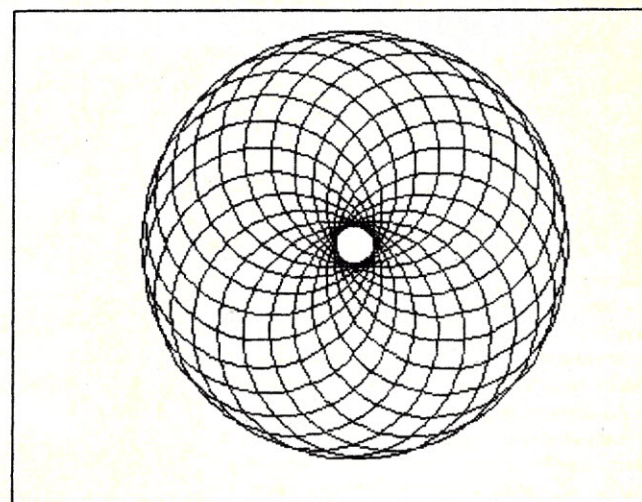
```

620 PRINT PAGE
630 PRINT "THIS IS A SPIRO-GRAPH PROGRAM"
640 PRINT "To create a design, we hold a pen a distance T from"
650 PRINT "the center of a circle with radius S, and spin it around "
660 PRINT "a circle with radius R. By selecting a good ratio for"
670 PRINT "R and S you can get some interesting designs. The SIGN"
680 PRINT "will be either 1 or -1. 1 means that the circle with radius"
690 PRINT "S rotates on the inside of the circle with radius R, and "
700 PRINT "-1 means that the circle with radius S spins on the "
710 PRINT "outside of the circle with radius R."
720 RETURN

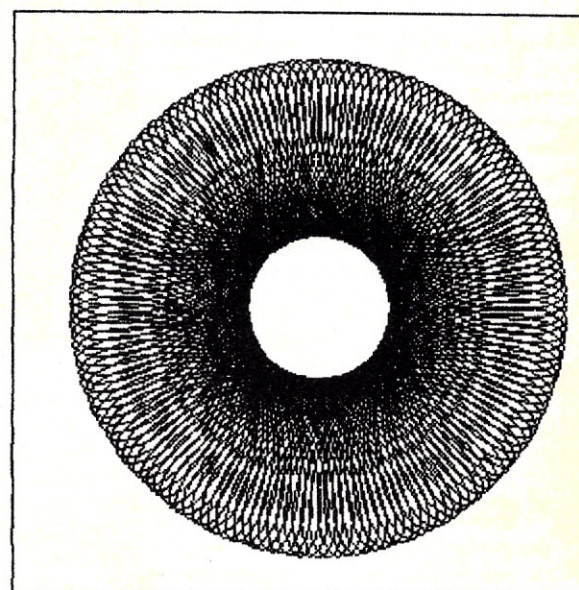
```



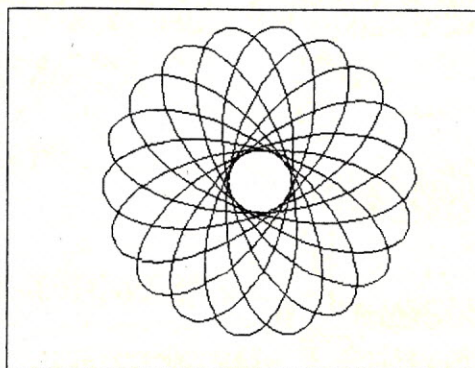
R=153 S=98 T=37 Sign=1



R=5 S=115 T=100 Sign=-1

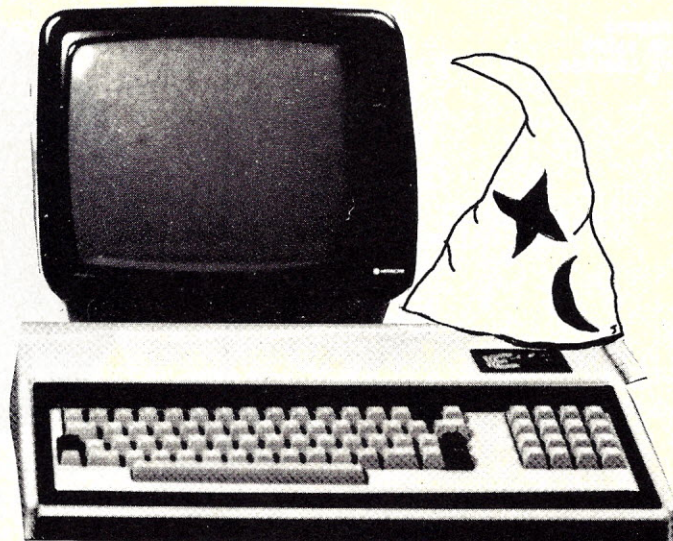


R=117 S=43 T=41 Sign=1



R=55 S=35 T=30 Sign=1





# High-Resolution Graphics For The Sorcerer

**Dale M. Gass**

For those of you Sorcerer users who need higher resolution than 64x30 for plotting and find when they use higher resolution plotting routines (such as Vic Tolomei's HIRES plot) they run out of graphic characters, here is a compromise. I have written a routine which allows the Sorcerer to plot on a grid 128x60 (similar to the TRS-80) without running out of graphic characters to plot with. Many TRS-80 programs which use plotting (such as in the TRS-80 column TRS-80 Strings can be converted to run on the Sorcerer.

The routine presented in this article is fairly short and resides in the memory locations 0000H-0076H and will fit on any Sorcerer.

Enter the program listed using the standard method described in "A Guided Tour of Personal Computing" which is supplied with every Sorcerer bought.

The plotting routine also requires that five of the programmable graphic characters be defined. The values for the graphic characters are listed below. Enter them in the standard method also.

```
FE00: FF FF FF FF F0 F0 F0 F0
FE03: FF FF FF FF 0F 0F 0F 0F
FE10: F0 F0 F0 F0 FF FF FF FF
FE18: 0F 0F 0F 0F FF FF FF FF
FE20: FF FF FF FF FF FF FF FF
```

Now comes the actual use of the routine. To start poke the values of zero into both locations 260 and 261 with the statement:  
10 POKE 260,0: POKE 261,0

Dale Gass, R.R. #1, Brookfield, Nova Scotia, Canada, B0N 1C0.

-----+  
!CONVERSION OF TRS-80 GRAPHICS PROGRAM TO SORCERER!  
-----+

For original program see 'TRS-80 STRINGS', Creative Computing, September 1979, page 186.

(NOTE: TRS-80 GRAPHICS SIMULATION PLOTTING ROUTINE MUST BE IN MEMORY (0000-0076) WHEN USING THIS PROGRAM.) -----

```
0 GOTO 100
1 POKE 100,1:GOTO 3
2 POKE 100,0
3 POKE 98,ROW:POKE 99,COL
4 Z9=USR(Z9):RETURN
100 CLEAR 100:PRINT CHR$(12);
103 POKE 260,0:POKE 261,0
106 DEF FNR(Z9)=INT(RND(1)*Z9+1)
110 X=FNR(20)
120 Y=FNR(10)
130 COL=X:ROW=Y:GOSUB 1
140 COL=X+1:ROW=Y+1:GOSUB 2
150 COL=41-X:ROW=Y:GOSUB 1
160 COL=40-X:ROW=Y+1:GOSUB 2
170 COL=X:ROW=21-Y:GOSUB 1
180 COL=X+1:ROW=20-Y:GOSUB 2
190 COL=41-X:ROW=21-Y:GOSUB 1
200 COL=40-X:ROW=20-Y:GOSUB 2;
GOTO 110
```

This sets the address of the call routine to the plotting routine at location 0000H.

Next poke the Y co-ordinate value into location 98 and the X co-ordinate value into 99 of the point you wish to plot with the statement:

20 POKE 98, Y:POKE 99,X

You now have two options: plot a white point at the co-ordinate specified in the last step, or erase a white point at the co-ordinate specified.

To plot a white point use the statement:  
30 POKE 100,1

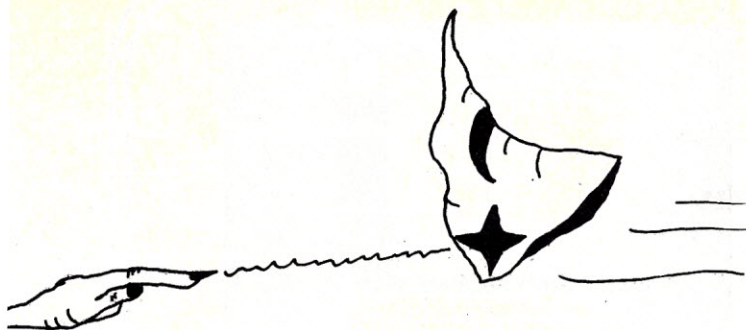
To erase a white point use the statement:  
30 POKE 100,0

You can now plot (or erase) the point specified with the statement 'Z9=USRZ9' or any equivalent call.

Caution: This routine does NOT check for illegal co-ordinates. If you are careless you could cause the routine to poke into vital areas of memory and cause a system crash.

The following is a listing of the plotting routine and a sample program which uses it. ☐





+-----+  
!SIMULATION OF TRS-80 GRAPHICS ON SORCERER!  
+-----+

```

0000: F5          START: PUSH AF
0001: C5          PUSH BC
0002: D5          PUSH DE
0003: E5          PUSH HL
0004: DD E5       PUSH IX
0006: AF          XOR A
0007: ED 4B 62 00 LD BC, <COORDS>
0008: CB 39       SRL C
000D: 8F          ADC A, A
000E: CB 38       SRL B
0010: 8F          ADC A, A
0011: 16 01       LD D, 01
0013: B7          OR A
0014: 28 05       JR Z, P1
0016: CB 22       P2: SLA D
0018: 3D          DEC A
0019: 28 FB       JR NZ, P2
001B: 67          LD H, A
001C: 69          LD L, C
001D: 3E 06       LD A, 06
001F: 29          P3: ADD HL, HL
0020: 3D          DEC A
0021: 28 FC       JR NZ, P3
0023: 48          LD C, B
0024: 47          LD B, A
0025: 09          ADD HL, BC
0026: 01 80 F0    LD BC, F000
0029: 09          ADD HL, BC
002A: 47          LD B, A
002B: 4E          LD C, <HL>
002C: DD 21 65 00 LD IX, TABLE
0030: DD 7E 00    P4: LD A, <IX+00>
0033: B7          OR A
0034: 28 08       JR Z, S1
0036: B9          CP C
0037: 28 06       JR Z, S2
0039: 04          INC B
003A: DD 23       INC IX
003C: 18 F2       JR P4
003E: 47          S1: LD B, A
003F: 3A 64 00    LD A, <MODE>
0042: B7          OR A
0043: 28 04       JR Z, S3
0045: 78          LD A, B
0046: B2          OR D
0047: 18 03       JR S4
0049: 7A          S3: LD A, D
004A: 2F          CPL
004B: A0          AND B
004C: 47          S4: LD B, A
004D: DD 21 64 00 LD IX, TABLE-1
0051: 04          INC B
0052: DD 23       S5: INC IX
0054: 05          DEC B
0055: 28 FB       JR NZ, S5
0057: DD 7E 00    LD A, <IX+00>
005A: 77          LD <HL>, A
005B: DD E1       POP IX
005D: E1          POP HL
005E: D1          POP DE
005F: C1          POP BC
0060: F1          POP AF
0061: C9          RET

```

BY Dale Gass (1980)

THIS IS A TABLE REFERRED TO BY THE PROGRAM AND MUST BE  
IN THE PROPER MEMORY LOCATION WHEN RUNNING. -----

0065: 20 A1 A0 A9 96 A7 A6 C0 95 A5 A8 C1 AA C2 C3 C4 00/



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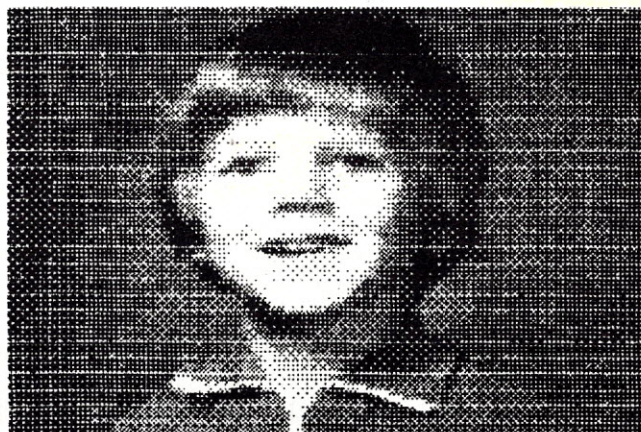
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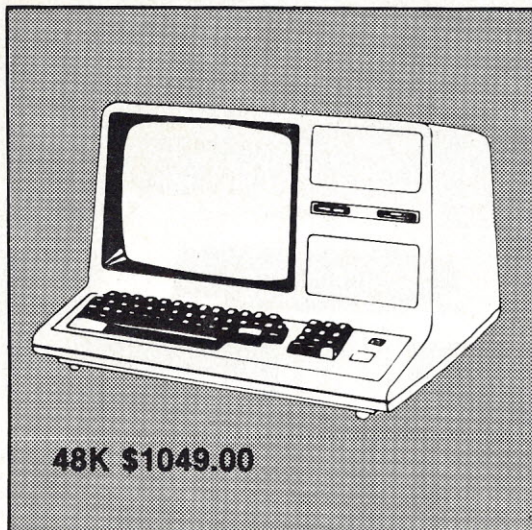
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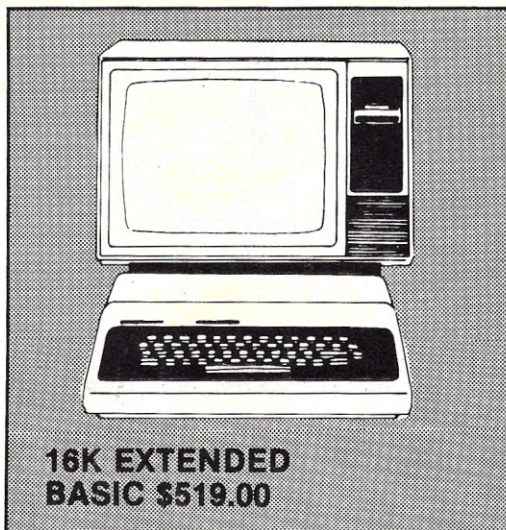






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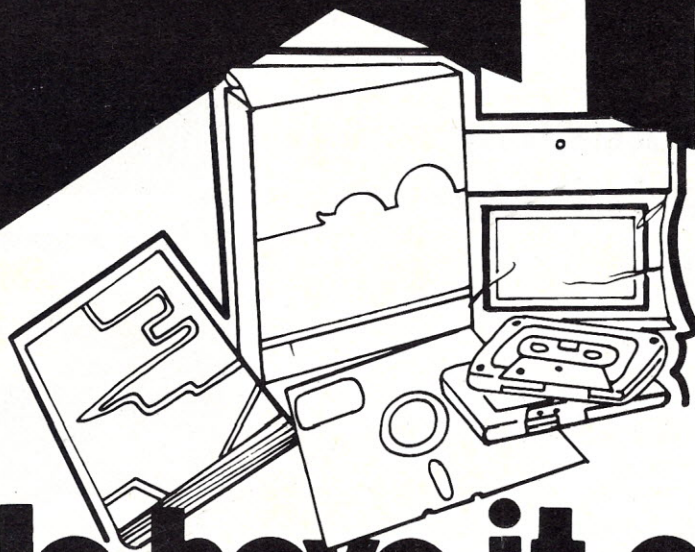
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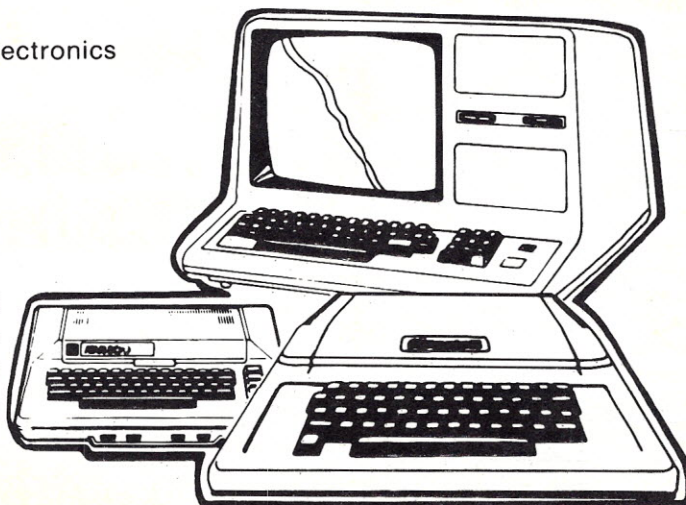
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# Low-Resolution Graphics for the Sorcerer

After watching the evolution of personal computers over the past six years, I recently decided to "grab for some of the gusto" by purchasing an Exidy Sorcerer. At \$1295 for the standard machine, the Sorcerer is a little more expensive than comparable systems from Apple, Commodore or Radio Shack. I was willing to spend the extra money because I felt the Sorcerer offered greater value per investment dollar.

The Sorcerer has a Z-80 cpu and the standard unit comes with 16K of memory. Memory is internally expandable to 48K. The keyboard has a professional feel and consists of 63 keys plus a 16-key numeric pad. Other standard features include an RS-232 serial interface which can be used to control two cassette recorders, a parallel interface compatible with Centronics printers, a video interface, and an expansion bus. The 1200 baud cassette interface is one of the most reliable I have seen; in five months of use I have had only two programs fail to load on the first attempt.

Two features that I believe give the Sorcerer an advantage over the competition are its use of plug-in ROM software packs and its graphics capabilities. The computer comes with 8K Microsoft Basic in ROM packaged in a device resembling an 8-track stereo tape. This device is plugged into the right side of the keyboard unit. If programming in Basic is not your cup of tea, you can purchase a cartridge containing assembler or one containing a word processor.

Having acquainted you with some of the Sorcerer's features, I can now proceed to the main topic of this article—the graphics capabilities of the computer. The video screen consists of 30 lines of 64 characters. Each character is represented as an 8X8 matrix of dots, yielding an effective resolution of 512 (64X8) horizontal by 240 (30X8) vertical points. The representation of each character is contained in 8 successive memory locations. Thus 2,048 memory locations are used to represent all 256 ASCII codes. The user can define up to 128 of his own characters by altering the contents of the memory locations assigned to ASCII codes 128-255.

Bob Stuckmeyer, 2347 Cavendish Lane, St. Louis, MO 63129.

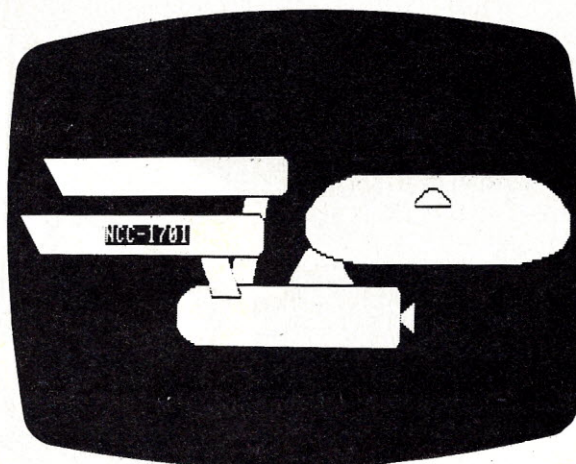


Photo 1. Sorcerer hi-resolution graphics.

I'll illustrate how to define characters by means of an example. Let's say that you wanted to display an upside down letter "A" on the screen. Figure 1 contains the dot matrix representation of this character.

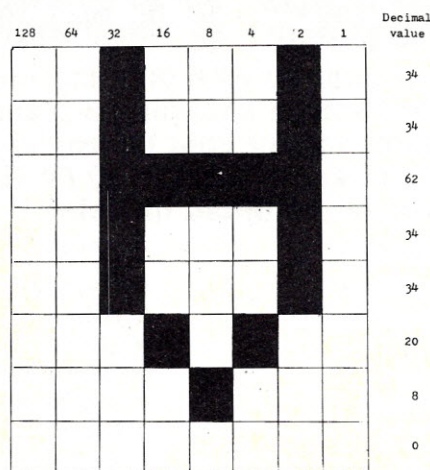


Figure 1. Dot matrix representation of upside down "A".

The following Basic statements assign this character to ASCII code 192 (arbitrary choice). Once the above statements are executed, the character could be displayed on the screen by the command PRINT CHR\$(192) or by POKEing 192 into the desired video RAM location.

```
10 REM MEMORY ADDRESSES -512 TO -505 CONTAIN THE
20 REM REPRESENTATION OF ASCII CODE 192
30 FOR I=-512 TO -505
40 READ X:POKE I,X
50 NEXT I
60 DATA 34,34,62,34,34,20,8,0
```

High-resolution graphics are accomplished by using this technique to define multiple graphic characters. A character might only represent a piece of a figure, and hence must be combined with other characters on the screen to display a complete figure. The figure in Photo 1 was constructed in this manner and required the definition of 71 unique characters.

## Bob Stuckmeyer

The process of defining and combining characters to create graphics is tedious, and ill-suited for applications like arithmetic function plotting or displaying the path of a photon torpedo. For these applications, a much simpler approach would be to specify a point's x and y coordinates along with a command to turn on the point. Similar commands would be required to turn off a point and to test a point to see if it is on or off. Level II Basic on Radio Shack's TRS-80 provides SET, RESET, and POINT commands which accomplish these functions.

The subroutines contained in Listing 1 will simulate these commands at the expense of resolution. Under the approach adopted, the ability to manipulate any of the 521X240 points would have required definition of enough graphic characters to account for all combinations of points on or off within a character. Since each character contains 64 dots, there are two possible representa-

tions (clearly exceeding the Sorcerer's capabilities). If each character is instead viewed as containing four points which can be on or off, only two graphics characters are necessary to account for all combinations of points (see figure 2). This approach yields a resolution of 128 horizontal by 60 vertical points slightly greater than that provided on the TRS-80.



**The story behind the two best selling computer games books in the world.**

# Computer Games

by David H. Ahl

Everybody likes games. Children like tic tac toe. Gamblers like blackjack. Trekkies like Star Trek. Almost everyone has a favorite game or two.

## It Started in 1971

Ten years ago when I was at Digital Equipment Corp. (DEC), we wanted a painless way to show reluctant educators that computers weren't scary or difficult to use. Games and simulations seemed like a good method.

So I put out a call to all our customers to send us their best computer games. The response was overwhelming. I got 21 versions of blackjack, 15 of nim and 12 of battleship.

From this enormous outpouring I selected the 90 best games and added 11 that I had written myself for a total of 101. I edited these into a book called 101 Basic Computer Games which was published by DEC. It still is.

When I left DEC in 1974 I asked for the rights to print the book independently. They agreed as long as the name was changed.

Contents of *Basic Computer Games* (right) and *More Basic Computer Games* (below).

Artillery-3	Life Expectancy
Baccarat	Lissajous
Bible Quiz	Magic Square
Big 6	Man-Eating Rabbit
Binary	Maneuvers
Blackbox	Mastermind
Bobstones	Masterbagels
Bocce	Matpuzzle
Boga II	Maze
Bumbrun	Millionaire
Bridge-It	Minotaur
Camel	Motorcycle Jump
Chase	Nomad
Chuck-A-Luck	Not One
Close Encounters	Obstacle
Column	Octrix
Concentration	Pasart
Condot	Pasart 2
Convoy	Pinball
Corral	Rabbit Chase
Countdown	Roadrace
Cup	Rotate
Dealer's Choice	Safe
Deepspace	Scales
Defuse	Schmoo
Dodgem	Seabattle
Doors	Seawar
Drag	Shoot
Dr. Z	Smash
Eliza	Strike 9
Father	Tennis
Flip	Tickertape
Four In A Row	TV Plot
Geowar	Twonky
Grand Prix	Two-to-Ten
Guess-It	UFO
ICBM	Under & Over
Inkblot	Van Gam
Joust	Warfish
Jumping Balls	Word Search Puzzle
Keno	Wumpus 1
L Game	Wumpus 2

Introduction	Hi-Lo
The Basic Language	High I-Q
Conversion to Other	Hockey
Basics	Horseshoe
Accey Ducey	Hurkle
Amazing	Kinema
Animal	King
Awari	Letter
Bagels	Life
Banner	Life For Two
Basketball	Literature Quiz
Batnum	Love
Battle	Lunar LEM Rocket
Blackjack	Master Mind
Bombardment	Math Dice
Bombs Away	Mugwump
Bounce	Name
Bowling	Nicomachus
Boxing	Nim
Bug	Number
Bullfight	One Check
Bullseye	Orbit
Bunny	Pizza
Buzzword	Poetry
Calendar	Poker
Change	Queen
Checkers	Reverse
Chemist	Rock, Scissors, Paper
Chief	Roulette
Chomp	Russian Roulette
Civil War	Salvo
Combat	Sine Wave
Craps	Slalom
Cube	Slots
Depth Charge	Splat
Diamond	Stars
Dice	Stock Market
Digits	Super Star Trek
Even Wins	Synonym
Flip Flop	Target
Football	3-D Plot
Fur Trader	3-D Tic-Tac-Toe
Golf	Tic Tac toe
Gomoko	Tower
Guess	Train
Gunner	Trap
Hammurabi	23 Matches
Hangman	War
Hello	Weekday
Hexapawn	Word

## Converted to Microsoft Basic

The games in the original book were in many different dialects of Basic. So Steve North and I converted all the games to standard Microsoft Basic, expanded the descriptions and published the book under the new name Basic Computer Games.

Over the next three years, people sent in improved versions of many of the games along with scores of new ones. So in 1979, we totally revised and corrected Basic Computer Games and published a completely new companion volume of 84 additional games called More Basic Computer Games. This edition is available in both Microsoft Basic and TRS-80 Basic for owners of the TRS-80 computer.

Today Basic Computer Games is in its fifth printing and More Basic Computer Games is in its second. Combined sales are over one half million copies making them the best selling pair of books in recreational computing by a wide margin. There are many imitators, but all offer a fraction of the number of games and cost far more.

The games in these books include classic board games like checkers. They include challenging simulation games like Camel (get across the desert on your camel) and Super Star Trek. There are number games like Guess My Number, Stars and Battle of Numbers. You'll find gambling games like blackjack, keno, and poker. All told there are 185 different games in these two books.

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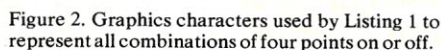
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***This approach yields  
a resolution of  
128 horizontal by  
60 vertical points.***

```

10 REM ** SORCERER LOW-RESOLUTION GRAPHICS DEMO **
15 REM ** BY **
20 REM ** BOB STUCKMEYER **
25 REM ** 2347 CAVENDISH LN **
30 REM ** ST. LOUIS, MO 63129 **
40 REM
50 REM ** THIS PROGRAM ILLUSTRATES USE OF LOW **
55 REM ** RESOLUTION GRAPHICS SUBROUTINES BY **
60 REM ** MOVING A POINT IN RANDOM DIRECTIONS. **
65 REM ** AS THE POINT IS MOVED TO EACH NEW LO- **
70 REM ** CATION THE LOCATION IS TURNED ON IF **
75 REM ** IT IS CURRENTLY OFF AND TURNED OFF **
80 REM ** OTHERWISE. **
85 REM
100 PRINT CHR$(12);CHR$(23);:GOSUB 7000
110 R=RND(-1):X=INT(RND(1)*128)
120 Y=INT(RND(1)*60):GOSUB 8000
130 R=INT(RND(1)*8)+1
140 ON R GOSUB 300,320,340,360,380,400,420,440
150 IF X>127 THEN X=0
160 IF X<0 THEN X=127
170 IF Y>59 THEN Y=0
180 IF Y<0 THEN Y=59
190 GOSUB 8600
200 IF P=1 THEN GOSUB 8400:GOTO 220
210 GOSUB 8000
220 GOTO 130
300 Y=Y+1:RETURN
320 X=X+1:Y=Y+1:RETURN
340 X=X+1:RETURN
360 X=X+1:Y=Y-1:RETURN
380 Y=Y-1:RETURN
400 X=X-1:Y=Y-1:RETURN
420 X=X-1:RETURN
440 X=X-1:Y=Y+1:RETURN
7000 REM ** SUBROUTINE THAT DEFINES GRAPHICS CHARACTERS **
7010 REM ** USED TO SET AND RESET POINTS ON THE SCREEN **
7020 FOR I=-512 TO -385:READ Z:POKE I,Z:NEXT I
7030 DATA 0,0,0,0,0,0,0,0 :REM CHR$(0)
7040 DATA 240,240,240,240,0,0,0,0 :REM CHR$(1)
7050 DATA 15,15,15,15,0,0,0,0 :REM CHR$(2)
7060 DATA 0,0,0,0,240,240,240,240 :REM CHR$(3)
7070 DATA 0,0,0,0,15,15,15,15 :REM CHR$(4)
7080 DATA 255,255,255,255,0,0,0,0 :REM CHR$(5)
7090 DATA 15,15,15,15,15,15,15,15 :REM CHR$(6)
7100 DATA 0,0,0,0,255,255,255,255 :REM CHR$(7)
7110 DATA 240,240,240,240,240,240,240,240 :REM CHR$(8)
7120 DATA 240,240,240,240,15,15,15,15 :REM CHR$(9)
7130 DATA 15,15,15,15,240,240,240,240 :REM CHR$(10)
7140 DATA 255,255,255,255,15,15,15,15 :REM CHR$(11)
7150 DATA 15,15,15,15,255,255,255,255 :REM CHR$(12)
7160 DATA 240,240,240,240,255,255,255,255 :REM CHR$(13)
7170 DATA 255,255,255,255,240,240,240,240 :REM CHR$(14)
7180 DATA 255,255,255,255,255,255,255,255 :REM CHR$(15)
7190 RETURN
8000 REM ** SUBROUTINE THAT SETS (TURNS ON) THE GRAPHICS **
8010 REM ** BLOCK GIVEN BY THE POINT (X,Y). X IS **
8020 REM ** BLOCK'S HORIZONTAL POSITION (0 THRU 127) **
8030 REM ** IS THE BLOCK'S VERTICAL POSITION (0 THRU 59) **
8040 REM ** THE POINT (0,0) IS THE LOWER LEFT HAND **
8050 REM ** CORNER OF THE SCREEN. **
8060 REM
8070 REM ** 1) RANGE CHECK **
8080 IF (X<0 OR X>127 OR Y<0 OR Y>59) THEN 8280
8090 X=INT(X):Y=INT(Y)
8100 REM ** 2) DETERMINE MEMORY ADDRESS OF CHARACTER **
8110 REM ** CONTAINING THE POINT (X,Y), AND **
8120 REM ** CHARACTER AT ADDRESS WITH PREVIOUS **
8130 REM ** DEFINED GRAPHICS CHARACTERS **
8150 GOSUB 9000
8160 REM ** 3) TURN ON GRAPHICS BLOCK (IF IT IS **
8180 J=-384
8190 IF INT(Y/2)=Y/2 THEN J=-380
8200 IF INT(X/2)=X/2 THEN 8240
8210 IF (PEEK(J)=15 OR PEEK(J)=255) THEN 8280

```



```

8220 FOR I=J TO J+3:POKE I,PEEK(I)+15:NEXT I
8230 GOTO 8260
8240 IF PEEK(J)>15 THEN 8280
8250 FOR I=J TO J+3:POKE I,PEEK(I)+240:NEXT I
8260 REM ** 4) STORE UPDATED CHARACTER **
8270 GOSUB 9400
8280 RETURN
8400 REM ** SUBROUTINE THAT RESETS (TURNS OFF) THE GRAPHICS **
8410 REM ** BLOCK GIVEN BY THE POINT (X,Y). **
8420 REM
8430 REM ** 1) RANGE CHECK **
8440 IF (X<0 OR X>127 OR Y<0 OR Y>59) THEN 8670
8450 X=INT(X):Y=INT(Y)
8460 REM ** 2) DETERMINE MEMORY ADDRESS OF CHARACTER **
8470 REM ** CONTAINING THE POINT (X,Y), AND MATCH **
8480 REM ** CHARACTER AT ADDRESS WITH PREVIOUSLY **
8490 REM ** DEFINED GRAPHICS CHARACTERS **
8510 GOSUB 9000
8560 REM ** 3) TURN OFF GRAPHICS BLOCK (IF IT IS ON) **
8570 J=-384
8580 IF INT(Y/2)=Y/2 THEN J=-380
8590 IF INT(X/2)=X/2 THEN 8630
8600 IF (PEEK(J)=0 OR PEEK(J)=240) THEN 8670
8610 FOR I=J TO J+3:POKE I,PEEK(I)-15:NEXT I
8620 GOTO 8650
8630 IF PEEK(J)<16 THEN 8670
8640 FOR I=J TO J+3:POKE I,PEEK(I)-240:NEXT I
8650 REM ** 4) STORE UPDATED CHARACTER **
8660 GOSUB 9400
8670 RETURN

8800 REM ** SUBROUTINE THAT DETERMINES IF THE GRAPHICS **
8810 REM ** BLOCK GIVEN BY THE POINT (X,Y) IS ON OR OFF. **
8820 REM ** THE VARIABLE P IS ASSIGNED A VALUE OF 0 TO **
8830 REM ** INDICATE 'OFF' AND A VALUE OF 1 FOR 'ON'. **
8840 P=0
8850 REM ** 1) RANGE CHECK **
8860 IF (X<0 OR X>127 OR Y<0 OR Y>59) THEN 8995
8870 X=INT(X):Y=INT(Y)
8880 REM ** 2) DETERMINE MEMORY ADDRESS OF CHARACTER **
8890 REM ** CONTAINING THE POINT (X,Y), AND MATCH **
8900 REM ** CHARACTER AT ADDRESS WITH PREVIOUSLY **
8910 REM ** DEFINED GRAPHICS CHARACTERS **
8930 GOSUB 9000
8940 REM ** 3) SEE IF GRAPHICS BLOCK IS ON **
8950 J=-384
8960 IF INT(Y/2)=Y/2 THEN J=-380
8970 IF INT(X/2)=X/2 THEN 8990
8980 IF (PEEK(J)=15 OR PEEK(J)=255) THEN P=1:GOTO 8995
8985 GOTO 8995
8990 IF PEEK(J)>15 THEN P=1
8995 RETURN
9000 REM ** SUBROUTINE THAT COMPUTES MEMORY ADDRESS OF **
9010 REM ** THE CHARACTER CONTAINING THE POINT (X,Y), **
9020 REM ** MATCHES THE CHARACTER WITH THE PREVIOUSLY **
9030 REM ** DEFINED GRAPHICS CHARACTERS. ONCE THE **
9035 REM ** CHARACTER IS MATCHED IT'S GRAPHIC REPRE- **
9040 REM ** SENTATION IS COPIED TO THE MEMORY LOCA- **
9050 REM ** TIONS WHICH DEFINE THE REPRESENTATION OF **
9060 REM ** CHR$(208). IF NO MATCH IS FOUND THE CHAR- **
9070 REM ** ACTER IS ASSUMED TO MATCH CHR$(192) (ALL **
9073 REM ** POINTS OFF). **
9077 AD=INT(X/2)-64*(INT(Y/2))-2112
9080 FOR I=-384 TO -377:POKE I,0:NEXT I
9090 FOR I=192 TO 207
9100 IF CHR$(PEEK(AD))<>CHR$(I) THEN 9140
9110 J=-512+((I-192)*8)
9120 FOR K=-384 TO -377:POKE K,PEEK(J):J=J+1:NEXT K
9130 GOTO 9150
9140 NEXT I
9150 RETURN
9400 REM ** SUBROUTINE WHICH STORES THE UPDATED CHARACTER **
9410 REM ** **
9420 REM ** UPON ENTRY THE UPDATED CHARACTER'S GRAPHIC **
9430 REM ** REPRESENTATION IS CONTAINED IN THE MEMORY **
9440 REM ** LOCATIONS WHICH DEFINE THE REPRESENTATION OF **
9450 REM ** CHR$(208). THIS REPRESENTATION IS COMPARED **
9460 REM ** WITH THE REPRESENTATIONS OF CHR$(192) THRU **
9470 REM ** CHR$(207). WHEN A MATCH IS FOUND THE UPDATED **
9480 REM ** CHARACTER IS STORED BY POKING THE ASCII VALUE **
9490 REM ** OF THE MATCHING CHARACTER INTO THE MEMORY AD- **
9500 REM ** DRESS OF THE POINT (X,Y). **
9510 FOR I=-512 TO -392 STEP 8
9520 FOR J=0 TO 7
9530 IF PEEK(I+J)<>PEEK(-384+J) THEN 9570
9540 NEXT J
9550 POKE AD,(I+512)/8+192
9560 GOTO 9580
9570 NEXT I
9580 RETURN

```



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Although the program in Listing 1 is fairly well documented, several points may require further clarification:

1) The colon (:) serves as a command delimiter.

2) PRINT CHR\$(12); CHR\$(23); will clear the screen and uppress the cursor.

3) RND (N) will start a different sequence of random numbers if N is negative, and will produce numbers between 0 and 1 if N is a positive integer.

4) Character representations of ASCII codes 192 thru -208 reside at addresses -512 thru -377.

5) Because the author's academic background was in mathematics, the four corners of the screen were assigned the coordinates depicted in Figure 3 (pay attention, Radio Shack!).

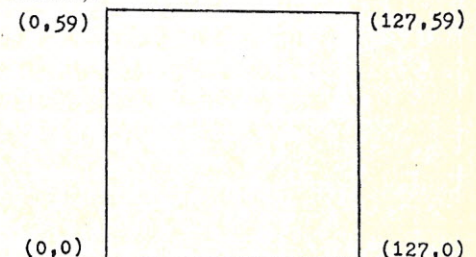
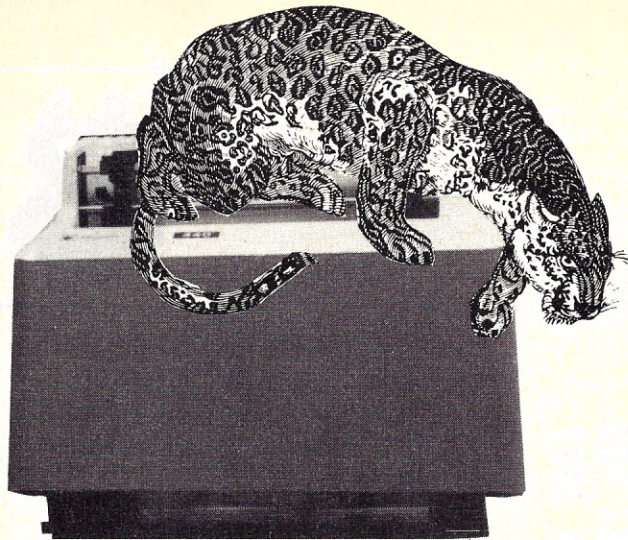


Figure 3. Screen coordinates.

Since these routines were written in Basic they run rather slowly. An obvious enhancement would be a machine-language implementation, accessible from Basic. □





# The Sorcerer Meets the Paper Tiger

**Bob Stuckmeyer**

8.3 characters per inch.  
 8.3 characters per inch, enhanced.  
 10 characters per inch.  
 10 characters per inch, enhanced.  
 12 characters per inch.  
 12 characters per inch, enhanced.  
 16.5 characters per inch.  
 16.5 characters per inch, enhanced.

Figure 1. Paper Tiger character sizes.

While I was able to select a personal computer only after several months of deliberation, choosing a printer to use with it was on the other hand, quite straightforward. The main features I required in a printer were: upper/lower case; an interface compatible with my Sorcerer's parallel port; and most importantly, the ability to reproduce any graphics displayed on the Sorcerer's video screen. Only one printer, the "Paper Tiger" from Integral Data Systems, met all of these requirements while still remaining in an affordable price range.

With a list price of \$995 and a variety of features, the Paper Tiger is one of the best values in the dot matrix printer market. Standard features include serial RS-232-C and parallel Centronics-compatible interfaces, adjustable pin-feed tractors which support paper widths from 1.75 to 9.5 inches, four character density (see Figure 1), and built-in diagnostics. For an additional \$99 a 2K buffer and graphics plotting mode can be added. The graphics option allows the printer to be used for printing illustrations, graphics, and charts; hence it met my main requirement of printing Sorcerer

graphics.

The Paper Tiger enters graphics mode upon receipt of an ETX character (hex 03). In this mode the printer uses a raster-scan technique to print columns of vertical dots during each pass of the print head. Up to seven dots can be printed in any column (see Figure 2). Because bit 6 of a received data character determines which positions are printed in each column (see Figure 2). Because bit 6 of each pass is overwritten by bit 0 of the next pass, bit 6 of each character should be set to zero—resulting in only 6 dots

Figure 2. Printer Operation in Graphics Mode.

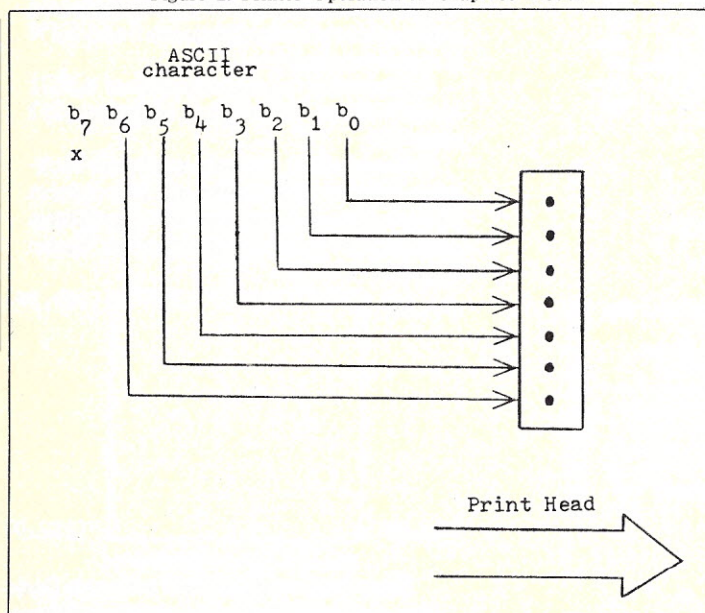
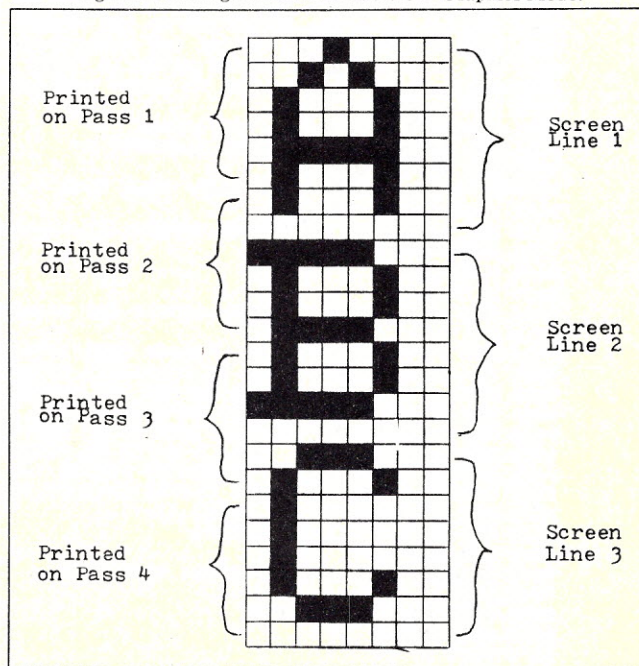


Figure 3. Printing Sorcerer Characters in Graphics Mode.



Bob Stuckmeyer, 2347 Cavendish Lane, St. Louis, MO 63129.



being printed on a pass.

Prior to discussing software for interfacing the Sorcerer with the Paper Tiger, a few of the Sorcerer's characteristics need explanation. The video screen consists of thirty lines of sixty-four characters. Characters are displayed as an 8X8 matrix of dots. Each ASCII character's representation is defined in eight bytes of memory. Graphic characters can be created by altering the representations of ASCII codes 128-255. Pictures are generated by defining and combining multiple graphic characters.

As one might expect, a problem arises when trying to print 8x8 graphic characters on a printer that prints six vertical dots per pass. Figure 3 illustrates this situation, in which 4 passes of the print head are required to print 3 screen lines. Another interface consideration is that the Paper Tiger prints a maximum of 498 horizontal dots per line—thus only allowing 62 of the Sorcerer's 64 characters to be printed per line.

Listing 1 is a Z-80 assembly language program that allows the Paper Tiger to function as the Sorcerer's "screen printer". The program is a subroutine which, when invoked, will duplicate on the printer any text or graphics that appears on the video. Figure 4 was created by calling this subroutine from Creative Computing's Lunar Lander game.

Finally, for those Sorcerer owners who may attempt to use this program, several points should be kept in mind:

1) The folks at Exidy did not equip their computer with a sure-fire method of protecting machine language subroutines from being clobbered by the Basic interpreter (the Sorcerer has no feature comparable to the TRS-80's MEMORY SIZE?).

2) The Sorcerer software manual suggests putting machine language subroutines in Basic freespace. Unfortunately freespace is dynamic; its location varies depending on the total amount of RAM, the program size and the amount of string space cleared by the program.

3) The program in Listing 1 resides in Basic freespace on a 16K machine. Consequently, it will probably have to be relocated to run on a Sorcerer with a different size memory.

4) I am willing to provide anyone having a Sorcerer Development Pac a cassette containing the source assembler language program (for a nominal charge). ☐

#### References

1. *Paper Tiger IDS-440 Impact Printer Owner's Manual*, Integral Data Systems Inc., 14 Tech Circle, Natick, MA 01760.
2. *Sorcerer Software Manual*, Exidy Incorporated, 390 Java Drive, Sunnyvale, CA 94086.

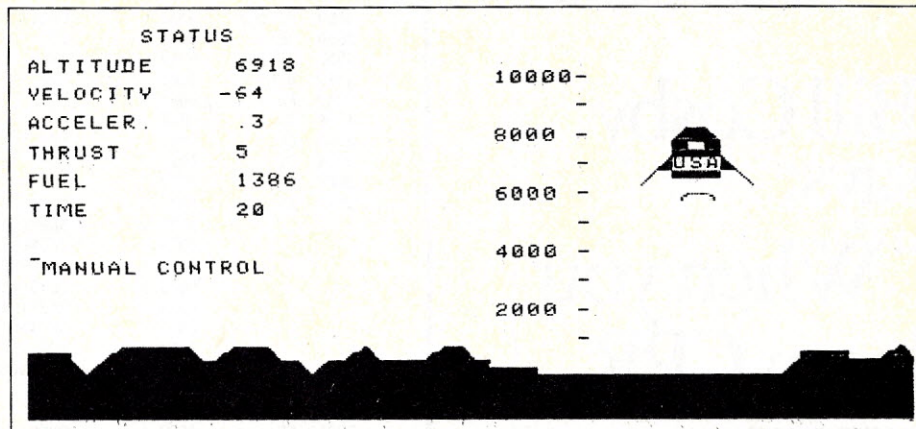


Figure 4. Print of Creative Computing's Lunar Lander display.

#### Listing 1

```

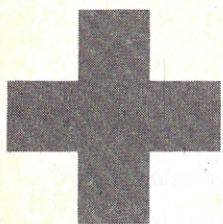
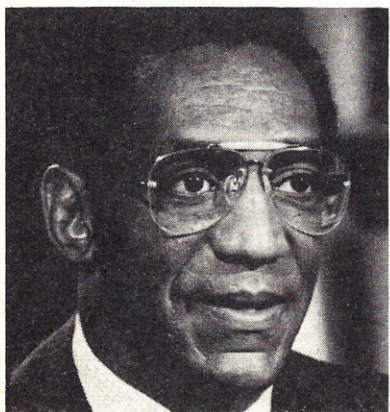
EXIDY Z-80 ASSEMBLER
ADDR  OBJECT  ST #

0001 ;      EXIDY SORCERER SCREEN PRINTER INTERFACE
0002 ;      FOR THE IDS-440 PAPER TIGER
0003 ;      BY BOB STUCKMEYER
0004 ;      2347 CAVENDISH LANE
0005 ;      ST LOUIS, MO 63129
0006 ;      03/25/80
0007 ;*****
0008 ;
0009 ;      ASCII EQUATES
0010 ;
>0003 0011 ETX  EQU  03H  #GRAPHICS MODE CONTROL CHAR
>000C 0012 FF  EQU  0CH  #FORM FEED
>000B 0013 VT  EQU  0BH  #VERTICAL TAB
>0011 0014 DC1 EQU  11H  #SELECT PRINTER
>0013 0015 DC3 EQU  13H  #DESELECT PRINTER
>0002 0016 STX EQU  02H  #NORMAL MODE CONTROL CHAR
>001E 0017 RS  EQU  1EH  #SELECT 12 CHAR PER INCH
0018 ;
0019 ;      RAM POINTERS
0020 ;
>F080 0021 SCREEN EQU  0F080H
>F800 0022 CHRDEF EQU  0F800H #ASCII CHAR REPRESENTATIONS
0023 ;
0024 PSECT ABS
0025 ORG 3856H
0026 ;
0027 ;      GENERAL INITIALIZATION
0028 ;
3856 F5 0029 SPRINT PUSH AF #WE DESTROY THESE
3857 C5 0030 PUSH BC
3858 E5 0031 PUSH HL
3859 D5 0032 PUSH DE
385A FDE5 0033 PUSH IY
385C DDE5 0034 PUSH IX
385E 2180F0 0035 LD HL,SCREEN
0036 ;
0037 ;      PRINTER INITIALIZATION
0038 ;
3861 3E11 0039 LD A,DC1 #SELECT PRINTER
3863 CD7D3A 0040 CALL CENOUT
3866 3E1E 0041 LD A,RS #SELECT 12 CPI
3868 CD7D3A 0042 CALL CENOUT
386B 3E03 0043 LD A,ETX #ENTER GRAPHICS MODE
386D CD7D3A 0044 CALL CENOUT
0045 ;
0046 ;      MAIN PROGRAM
0047 ;
3870 060A 0048 LD B,10D
3872 CD9938 0049 MLOOP CALL PLINE #PRINT NEXT 3 LINES
3875 1600 0050 LD D,0D
3877 1EC0 0051 LD E,192D
3879 19 0052 ADD HL,DE #POINT TO NEXT 3 LINES
387A 10F6 0053 DJNZ MLOOP-$
0054 ;
0055 ;      PROGRAM WINDUP
0056 ;
387C 3E03 0057 LD A,ETX
387E CD7D3A 0058 CALL CENOUT
3881 3E02 0059 LD A,STX #RETURN TO NORMAL MODE
3883 CD7D3A 0060 CALL CENOUT
3886 3E0C 0061 LD A,FF #ISSUE FORM FEED

```



Bill Cosby  
says:  
“When you  
learn CPR,  
you’re  
ready to  
save lives—  
anywhere.”



American  
Red Cross

## Paper Tiger, continued...

```


3888 CD7D3A 0062 CALL CENOUT
388B 3E13 0063 LD A,DC3 ;DESELECT PRINTER
388D CD7D3A 0064 CALL CENOUT
3890 DDE1 0065 POP IX
3892 FDE1 0066 POP IY
3894 D1 0067 POP DE
3895 E1 0068 POP HL
3896 C1 0069 POP BC
3897 F1 0070 POP AF
3898 C9 0071 RET
0072 ; SUBROUTINE THAT PRINTS 3 SCREEN LINES.
0073 ; BECAUSE THE SORCERER'S CHARACTERS ARE 8X8
0074 ; AND THE PAPER TIGER ONLY PRINTS 6 VERTICAL
0075 ; DOTS PER PASS, 4 PASSES ARE REQUIRED TO
0076 ; PRINT 3 LINES. PASS 1 PRINTS THE TOP 6 DOTS
0077 ; OF THE FIRST LINE. PASS 2 PRINTS THE LAST 2
0078 ; DOTS OF THE FIRST LINE AND THE TOP 4 DOTS OF
0079 ; THE SECOND LINE AND SO ON.
0080 ;
3899 C5 0081 PLINE PUSH BC ;WE DESTROY
389A E5 0082 PUSH HL
389B DDE1 0083 POP IX ;POINT IX TO CURRENT LINE
389D 063E 0084 LD B,62D ;LOOP FOR 62 CHARS PER LINE
389F CDDA38 0085 PLOOP1 CALL T6 ;PRINT TOP 6 DOTS
38A2 DD23 0086 INC IX
38A4 10F9 0087 DJNZ PLOOP1-$
38A6 CD383A 0088 CALL NEWLN ;START NEW LINE
38A9 E5 0089 PUSH HL
38AA DDE1 0090 POP IX ;POINT IX BACK
38AC 063E 0091 LD B,62D
38AE CD0E39 0092 PLOOP2 CALL B2T4
38B1 DD23 0093 INC IX
38B3 10F9 0094 DJNZ PLOOP2-$
38B5 CD383A 0095 CALL NEWLN ;START NEW LINE
38B8 DD23 0096 INC IX ;SKIP LAST TWO CHARS ON SCREEN
38BA DD23 0097 INC IX
38BC DDE5 0098 PUSH IX ;SAVE ADDR OF CURRENT LINE
38BE 063E 0099 LD B,62D
38C0 CD6F39 0100 PLOOP3 CALL B4T2
38C3 DD23 0101 INC IX
38C5 10F9 0102 DJNZ PLOOP3-$
38C7 CD383A 0103 CALL NEWLN
38CA DDE1 0104 POP IX
38CC 063E 0105 LD B,62D
38CE CD0039 0106 PLOOP4 CALL B6
38D1 DD23 0107 INC IX
38D3 10F9 0108 DJNZ PLOOP4-$
38D5 CD383A 0109 CALL NEWLN
38D8 C1 0110 POP BC ;RESTORE
38D9 C9 0111 RET
0112 ;
0113 ; SUBROUTINE WHICH PRINTS TOP 6 DOTS OF
0114 ; A CHARACTER
0115 ;
38DA E5 0116 T6 PUSH HL ;WE DESTROY
38DB C5 0117 PUSH BC
38DC CD153A 0118 CALL INITCHR ;ZERO WORK CHARS
38DF 2100F8 0119 LD HL,CHRDEF
38E2 1600 0120 LD D,0D
38E4 DD5E00 0121 LD E,(IX+0D) ;LOAD CHAR IN E
38E7 CD083A 0122 CALL MPY8 ;MULTIPLY BY 8
38EA 19 0123 ADD HL,DE ;POINT TO CHAR'S REPRESENTATION
38EB 1E00 0124 LD E,0D ;LOOP FOR 6 VERT DOTS
38ED 0608 0125 T6LP1 LD B,8D ;LOOP FOR 8 HORZ DOTS
38EF 7E 0126 LD A,(HL)
38F0 FD21943A 0127 LD IY,WKCHR
38F4 CB7F 0128 T6LP2 BIT 7,A
38F6 2803 0129 JR Z,T6CNT-$
38F8 CD433A 0130 CALL SETBIT
38FB CB07 0131 T6CNT RLC A
38FD FD23 0132 INC IY
38FF 10F3 0133 DJNZ T6LP2-$
3901 23 0134 INC HL
3902 1C 0135 INC E
3903 7B 0136 LD A,E
3904 FE06 0137 CP 6D
3906 20E5 0138 JR NZ,T6LP1-$
3908 CD203A 0139 CALL CHROUT ;OUTPUT WORK CHARS
390B C1 0140 POP BC
390C E1 0141 POP HL
390D C9 0142 RET
0143 ;
0144 ; SUBROUTINE WHICH PRINTS BOTTOM 2 DOTS OF A
0145 ; CHAR AND TOP 4 DOTS OF CHAR ON NEXT LINE.
0146 ;
390E E5 0147 B2T4 PUSH HL ;WE DESTROY
390F C5 0148 PUSH BC
3910 CD153A 0149 CALL INITCHR
3913 2100F8 0150 LD HL,CHRDEF
3916 1600 0151 LD D,0D

```





3918	DD5E00	0152	LD	E,(IX+0D)
391B	CD083A	0153	CALL	MPY8
391E	7B	0154	LD	A,E
391F	C606	0155	ADD	A,6D
3921	5F	0156	LD	E,A
3922	19	0157	ADD	HL,DE ;POINT TO CHAR'S REPRESENTATION
3923	1E00	0158	LD	E,0D ;LOOP FOR 2 VERT DOTS
3925	0608	0159 B2LP1	LD	B,8D ;LOOP FOR 8 HORZ DOTS
3927	7E	0160	LD	A,(HL)
3928	FD21943A	0161	LD	IY,WKCHR
392C	CB7F	0162 B2LP2	BIT	7,A
392E	2803	0163	JR	Z,B2CNT-\$
3930	CD433A	0164	CALL	SETBIT
3933	CB07	0165 B2CNT	RLC	A
3935	FD23	0166	INC	IY
3937	10F3	0167	DJNZ	B2LP2-\$
3939	23	0168	INC	HL
393A	1C	0169	INC	E
393B	7B	0170	LD	A,E
393C	FE02	0171	CP	2D
393E	20E5	0172	JR	NZ,B2LP1-\$
3940	2100F8	0173	LD	HL,CHRDEF
3943	1600	0174	LD	D,0D
3945	DD5E40	0175	LD	E,(IX+64D) ;LOAD CHAR ON NEXT LINE
3948	CD083A	0176	CALL	MPY8
394B	19	0177	ADD	HL,DE
394C	1E02	0178	LD	E,2D ;LOOP FOR 4 VERT DOTS
394E	0608	0179 T4LP1	LD	B,8D ;LOOP FOR 8 HORZ DOTS
3950	7E	0180	LD	A,(HL)
3951	FD21943A	0181	LD	IY,WKCHR
3955	CB7F	0182 T4LP2	BIT	7,A
3957	2803	0183	JR	Z,T4CNT-\$
3959	CD433A	0184	CALL	SETBIT
395C	CB07	0185 T4CNT	RLC	A
395E	FD23	0186	INC	IY
3960	10F3	0187	DJNZ	T4LP2-\$
3962	23	0188	INC	HL
3963	1C	0189	INC	E
3964	7B	0190	LD	A,E
3965	FE06	0191	CP	6D
3967	20E5	0192	JR	NZ,T4LP1-\$
3969	CD203A	0193	CALL	CHROUT ;OUTPUT WORK CHARS
396C	C1	0194	POP	BC ;RESTORE
396D	E1	0195	POP	HL
396E	C9	0196	RET	
		0197 ;		
		0198 ;		
		0199 ;		
		0200 ;		
			SUBROUTINE WHICH PRINTS BOTTOM 4 DOTS OF	
			A CHAR AND TOP 2 DOTS OF CHAR ON NEXT LINE	
396F	E5	0201 B4T2	PUSH	HL ;WE DESTROY
3970	C5	0202	PUSH	BC
3971	CD153A	0203	CALL	INITCHR
3974	2100F8	0204	LD	HL,CHRDEF
3977	1600	0205	LD	D,0D
3979	DD5E00	0206	LD	E,(IX+0D)
397C	CD083A	0207	CALL	MPY8
397F	7B	0208	LD	A,E
3980	C604	0209	ADD	A,4D
3982	5F	0210	LD	E,A
3983	19	0211	ADD	HL,DE ;POINT TO CHAR'S REPRESENTATION
3984	1E00	0212	LD	E,0D ;LOOP FOR 4 VERT DOTS
3986	0608	0213 B4LP1	LD	B,8D ;LOOP FOR 8 HORZ DOTS
3988	7E	0214	LD	A,(HL)
3989	FD21943A	0215	LD	IY,WKCHR
398D	CB7F	0216 B4LP2	BIT	7,A
398F	2803	0217	JR	Z,B4CNT-\$
3991	CD433A	0218	CALL	SETBIT
3994	CB07	0219 B4CNT	RLC	A
3996	FD23	0220	INC	IY
3998	10F3	0221	DJNZ	B4LP2-\$
399A	23	0222	INC	HL
399B	1C	0223	INC	E
399C	7B	0224	LD	A,E
399D	FE04	0225	CP	4D
399F	20E5	0226	JR	NZ,B4LP1-\$



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## Paper Tiger, continued...

39A1	2100F8	0227	LD	HL,CHRDEF
39A4	1600	0228	LD	D,0D
39A6	DD5E40	0229	LD	E,(IX+64D) #LOAD CHAR ON NEXT LINE
39A9	CD083A	0230	CALL	MPY8
39AC	19	0231	ADD	HL,DE
39AD	1E04	0232	LD	E,4D #LOOP FOR 2 VERT DOTS
39AF	0608	0233 T2LP1	LD	B,8D #LOOP FOR 8 HORZ DOTS
39B1	7E	0234	LD	A,(HL)
39B2	FD21943A	0235	LD	IY,WKCHR
39B6	CB7F	0236 T2LP2	BIT	7,A
39B8	2803	0237	JR	Z,T2CNT-\$
39BA	CD433A	0238	CALL	SETBIT
39BD	CB07	0239 T2CNT	RLC	A
39BF	FD23	0240	INC	IY
39C1	10F3	0241	DJNZ	T2LP2-\$
39C3	23	0242	INC	HL
39C4	1C	0243	INC	E
39C5	7B	0244	LD	A,E
39C6	FE06	0245	CP	6D
39C8	20E5	0246	JR	NZ,T2LP1-\$
39CA	CD203A	0247	CALL	CHROUT #OUTPUT WORK CHARS
39CD	C1	0248	POP	BC #RESTORE
39CE	E1	0249	POP	HL
39CF	C9	0250	RET	
		0251 ;		
		0252 ;		SUBROUTINE WHICH PRINTS BOTTOM 6 DOTS OF A CHAR.
		0253 ;		
39D0	E5	0254 B6	PUSH	HL #WE DESTROY
39D1	C5	0255	PUSH	BC
39D2	CD153A	0256	CALL	INITCHR
39D5	2100F8	0257	LD	HL,CHRDEF
39D8	1600	0258	LD	D,0D
39DA	DD5E40	0259	LD	E,(IX+64D)
39DD	CD083A	0260	CALL	MPY8
39E0	7B	0261	LD	A,E
39E1	C602	0262	ADD	A,2D
39E3	5F	0263	LD	E,A
39E4	19	0264	ADD	HL,DE #POINT TO CHAR'S REPRESENTATION
39E5	1E00	0265	LD	E,0D #LOOP FOR 6 VERT DOTS
39E7	0608	0266 B6LP1	LD	B,8D #LOOP FOR 8 HORZ DOTS
39E9	7E	0267	LD	A,(HL)
39EA	FD21943A	0268	LD	IY,WKCHR
39EE	CB7F	0269 B6LP2	BIT	7,A
39F0	2803	0270	JR	Z,B6CNT-\$
39F2	CD433A	0271	CALL	SETBIT
39F5	CB07	0272 B6CNT	RLC	A
39F7	FD23	0273	INC	IY
39F9	10F3	0274	DJNZ	B6LP2-\$
39FB	23	0275	INC	HL
39FC	1C	0276	INC	E
39FD	7B	0277	LD	A,E
39FE	FE06	0278	CP	6D
3A00	20E5	0279	JR	NZ,B6LP1-\$
3A02	CD203A	0280	CALL	CHROUT #OUTPUT WORK CHARS
3A05	C1	0281	POP	BC
3A06	E1	0282	POP	HL
3A07	C9	0283	RET	
		0284 ;		
		0285 ;		SUBROUTINE WHICH MULTIPLIES DE REG PAIR BY 8
		0286 ;		
3A08	CB23	0287 MPY8	SLA	E
3A0A	CB12	0288	RL	D
3A0C	CB23	0289	SLA	E
3A0E	CB12	0290	RL	D
3A10	CB23	0291	SLA	E
3A12	CB12	0292	RL	D
3A14	C9	0293	RET	
		0294 ;		
		0295 ;		SUBROUTINE WHICH ZEROS WORK CHARS
		0296 ;		
3A15	21943A	0297 INITCHR	LD	HL,WKCHR
3A18	0608	0298	LD	B,8D
3A1A	3600	0299 INITLP	LD	(HL),0H
3A1C	23	0300	INC	HL
3A1D	10FB	0301	DJNZ	INITLP-\$
3A1F	C9	0302	RET	
		0303 ;		
		0304 ;		SUBROUTINE WHICH WRITES WORK CHARS TO
		0305 ;		PRINTER
		0306 ;		
3A20	FD21943A	0307 CHROUT	LD	IY,WKCHR
3A24	0608	0308	LD	B,8D
3A26	FD7E00	0309 CHRLP	LD	A,(IY+0D)
3A29	CD7D3A	0310	CALL	CENOUT
3A2C	FE03	0311	CP	ETX
3A2E	2003	0312	JR	NZ,CHRCNT-\$
3A30	CD7D3A	0313	CALL	CENOUT
3A33	FD23	0314 CHRCNT	INC	IY



```

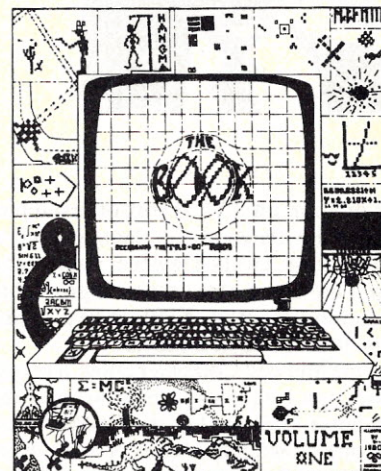
3A35 10EF 0315 DJNZ CHRLP-$
3A37 C9 0316 RET
0317 ;
0318 ; SUBROUTINE WHICH POSITIONS PRINT HEAD TO
0319 ; START OF NEW LINE
0320 ;
3A38 3E03 0321 NEWLN LD A,ETX
3A3A CD7D3A 0322 CALL CENOUT
3A3D 3E0B 0323 LD A,VT
3A3F CD7D3A 0324 CALL CENOUT
3A42 C9 0325 RET
0326 ;
0327 ; SUBROUTINE WHICH SETS A BIT (SELECTED BY
0328 ; VALUE IN REG E) IN WORK AREA POINTED TO
0329 ; BY IY
0330 ;
3A43 F5 0331 SETBIT PUSH AF ;WE DESTROY
3A44 7B 0332 LD A,E
3A45 FE00 0333 CP 0D
3A47 2006 0334 JR NZ,CHECK1-$
3A49 FDCB00C6 0335 SET 0,(IY+0D)
3A4D 182C 0336 JR SETRTN-$
3A4F FE01 0337 CHECK1 CP 1D
3A51 2006 0338 JR NZ,CHECK2-$
3A53 FDCB00CE 0339 SET 1,(IY+0D)
3A57 1822 0340 JR SETRTN-$
3A59 FE02 0341 CHECK2 CP 2D
3A5B 2006 0342 JR NZ,CHECK3-$
3A5D FDCB00D6 0343 SET 2,(IY+0D)
3A61 1818 0344 JR SETRTN-$
3A63 FE03 0345 CHECK3 CP 3D
3A65 2006 0346 JR NZ,CHECK4-$
3A67 FDCB00DE 0347 SET 3,(IY+0D)
3A6B 180E 0348 JR SETRTN-$
3A6D FE04 0349 CHECK4 CP 4D
3A6F 2006 0350 JR NZ,SET5-$
3A71 FDCB00E6 0351 SET 4,(IY+0D)
3A75 1804 0352 JR SETRTN-$
3A77 FDCB00EE 0353 SET5 SET 5,(IY+0D)
3A7B F1 0354 SETRTN POP AF ;RESTORE
3A7C C9 0355 RET
0356 ;
0357 ; SUBROUTINE THAT OUTPUTS CHAR IN REG A
0358 ; TO PRINTER
0359 ;
3A7D F5 0360 CENOUT PUSH AF
3A7E F5 0361 PUSH AF
3A7F DBFF 0362 CENBSY IN A,(OFFH)
3A81 CB7F 0363 BIT 7,A
3A83 20FA 0364 JR NZ,CENBSY-$
3A85 F1 0365 POP AF
3A86 F6B0 0366 OR 80H
3A88 D3FF 0367 OUT (OFFH),A
3A8A E67F 0368 AND 7FH
3A8C D3FF 0369 OUT (OFFH),A
3A8E F6B0 0370 OR 80H
3A90 D3FF 0371 OUT (OFFH),A
3A92 F1 0372 POP AF
3A93 C9 0373 RET
0374 ;
0375 ; WORK AREAS
0376 ;
3A94 00 0377 WKCHR DEFB 00H
3A95 00 0378 DEFB 00H
3A96 00 0379 DEFB 00H
3A97 00 0380 DEFB 00H
3A98 00 0381 DEFB 00H
3A99 00 0382 DEFB 00H
3A9A 00 0383 DEFB 00H
3A9B 00 0384 DEFB 00H
ERRORS=0000
3933 B2LP1 3925 B2LP2 392C
B2T4 390E B4CNT 3994 B4LP1 3986
B4LP2 398D B4T2 396F B6 39D0
B6CNT 39F5 B6LP1 39E7 B6LP2 39EE
CENBSY 3A7F CENOUT 3A7D CHECK1 3A4F
CHECK2 3A59 CHECK3 3A63 CHECK4 3A6D
CHRCNT 3A33 CHRDEF F800 CHRLP 3A26
CHROUT 3A20 DC1 0011 DC3 0013
ETX 0003 FF 000C INITCH 3A15
INITLP 3A1A MLOOP 3872 MPY8 3A08
NEWLN 3A38 PLINE 3899 PLOOP1 389F
PLOOP2 38AE PLOOP3 38C0 PLOOP4 38CE
RS 001E SCREEN F080 SET5 3A77
SETBIT 3A43 SETRTN 3A7B SPRINT 3856
STX 0002 T2CNT 39BD T2LP1 39AF
T2LP2 3986 T4CNT 395C T4LP1 394E
T4LP2 3955 T6 38DA T6CNT 38FB
T6LP1 38ED T6LP2 38F4 VT 000B
WKCHR 3A94

```

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TO BASIC

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# DITHERING HEIGHTS

**Ken Recters**

Is that me on TV? It sort of resembles me, but the image is just black and white with no grays. I walk a few feet further and there I am again, this time with grays, but the motion is jerky. Kind of like seeing every 10th frame of a movie.

At the Midwest Computer Show, a goodly crowd was frequently found around the Computer Station booth. People were watching those crazy images of themselves. They certainly weren't the familiar closed-circuit images produced by a camera and monitor. Something else had been added—an Apple computer. Elbowing closer to the booth, and making way for those who, with screen dumps grasped in their hands, were leaving, I got my first look at the Dithertizer II. I was impressed.

Taking input through a black and white Sanyo VC 1610X camera, the Dithertizer could put a picture on the Apple hi-res screen in less than a second. The person demonstrating the system explained that most of the existing low-cost digitizers take almost five seconds to produce a picture. The Dithertizer requires only 1/60th of a

second to grab a binary picture. (The Micro Works system requires almost 5 seconds to grab an image.) The Dithertizer is fast by virtue of the fact that it uses a DMA (direct memory access) type of binary video digitizing versus a frame grabber. These binary frames are combined into dithered matrices of 2X2, 4X4, or 8X8. A 2X2 matrix requires 4 frames, a 4X4 requires 16, and an 8X8 requires 64. Increasing the size of the matrix allows for higher contrast and, therefore, more shades of gray. In other words, an 8X8 matrix provides 64 levels of gray from white to black. The actual picture takes from 1/15 of a second for the smallest matrix to 1 and 1/15 seconds for the largest matrix. Since the image could be redrawn at this rate, a slightly-less-than-real-time motion could be seen on the screen. The term "dithering" refers to the process of producing the appearance of gray scales by means of overlaying.

From what I could see, the user is given many ways to interact with the system. Intensity and contrast are controlled with the paddles. With one press of a key, the

Dithertizer can switch to producing straight black and white images with no gray scales. Using the paddles, a variety of interesting contour pictures can be produced. A contour image is produced by subtracting one frame from another so that you end up with just the outline of the image, i.e., you just pick up the contour edging. This requires two frames and takes 1/30th of a second to produce. Using contours, images can be produced faster than those with gray scales; you nearly have animation. Using these techniques alone or together allows the user to experiment with various artistic interpretations, or whatever else suits his fancy. Another key freezes the image. From here, it can be saved to disk. The image can also be sent to any printer capable of dumping the hi-res screen. This requires another program which is included with the package.

So, what can you do with the Dithertizer? You can make pictures of your friends, or of anything else a video camera can spy out. With a printer, the pictures could be turned into posters. And, since the scene can be saved from disk and recalled, it can be decorated later with text or shapes from a table. With the right software, many interesting things can be done to the image. With pictures on file, you can spice up your software with great graphics. According to Lynn Sullivan, president of the Computer Station, manufacturers of the Dithertizer, many "real world" applications are possible. For example, gray levels can be extracted from aerial photographs. One professor is using it for work in geology. Another is using it to study sexual response and behavior in rats. It is useful for this because it is a much more sensitive movement detector than a regular video camera.

The Dithertizer II board, with software, sells for \$300. The Sanyo VC 1610X camera is \$410. If you buy both, the price drops to \$650. This \$650 package also includes software to produce a hard-copy image on either the Paper Tiger 440 or 460 printers. An Apple Silent Writer printer can also be used by storing the hi-res page and then dumping it out. All the software commands are one letter, for example, C for contour, D for dither and P for print. The package is available from Peripherals Plus, 39 East Hanover Ave., Morris Plains, New Jersey 07950. For further information, call (201) 267-4558.

For other articles on digitizing, see "Periphicon 511 Optical Image Digitizer," *Creative Computing*, vol. 5, number 10. This review presents background information and suggests several interesting applications for computers with cameras. "Image Processing with COMPIC's Computer Portrait System," from vol. 5, number 8, presents a detailed look at the joys and woes of a computer-oriented business, as well as a complete description of the materials required for computer portraits. □



Lynn Sullivan, president of the Computer Station, as seen by the Dithertizer II.



# Suddenly, RCA makes talking to your computer a lot cheaper.

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Unique color locking circuitry creates sharp, jitter free, true color graphics and rainbow free characters.

Displays the entire field of characters in any of 8 colors against any of 8 background colors (7 gray scales with monochrome monitors). Or to add special emphasis, you can display individual letters, words or lines in different colors or in reverse video.

The VP-3301 offers you a choice of two software-selectable display formats: Either 40 characters by 24 lines. Or 20 characters by 12 lines.

The terminal's resident character set consists of 52 upper and lower case alphabets, 10 numerals, 32 punctuation/math symbols, and 31 control characters.

You can also define a total of 128 of your own characters. Including: Greek letters and other foreign alphabets, graphic symbols, large graphics building blocks, playing card suits, unique character fonts, and "little green men."

The keyboard section features flexible-membrane key switches with contact life rated at greater than five million operations. A finger positioning overlay and positive keypress action give good operator "feel".

An on-board sound generator and speaker provides aural feedback for key presses and may also be activated with escape sequences to provide an audio output.

The sealed keyboard surface is spill proof and dust proof. This combined with high noise immunity CMOS circuitry makes the VP-3301 ideal for hostile environments.

Output is industry standard asynchronous RS232C or 20 mA current loop with six switch selectable baud rates and 8 selectable data formats.

The terminal can be connected directly to a 525 line color or monochrome monitor. Or to a standard TV set using an Rf modulator.

For more information, contact RCA MicroComputer Marketing, New Holland Avenue, Lancaster, PA 17604.

**Or call our toll-free number: 800-233-0094.**

\*Suggested user price.

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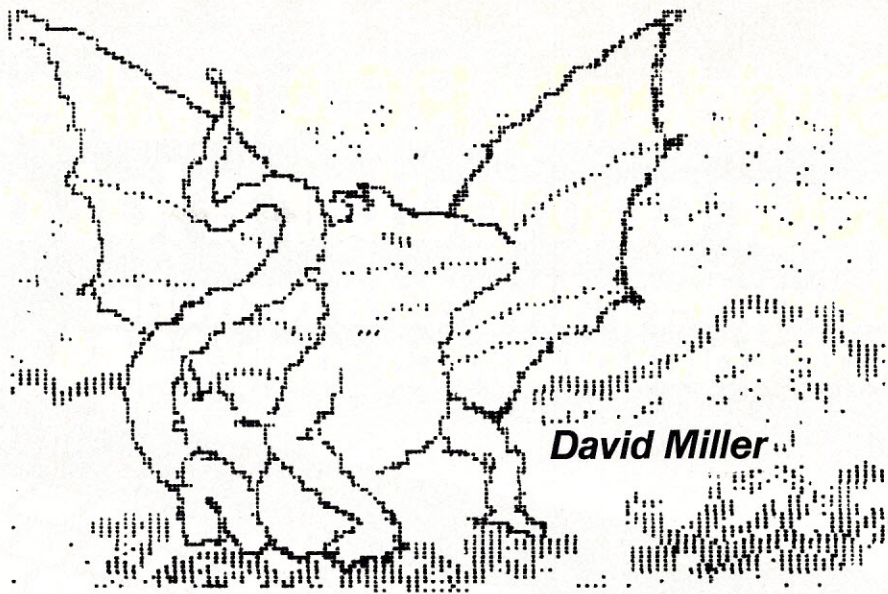
# Apple-Sketch

When I first bought my Apple II computer a few months ago, I was very excited about using the high resolution graphics that would surely dazzle my friends. I had visions of swooping spacecraft catapulting across the screen, of finely detailed game displays; but most of all, I relished the possibility of drawing freely, in color, on the high resolution screen. What possibilities, I thought: a 45000 point display (give or take a few), with six available colors. Surely there would be an easy way to make it do my bidding! So I spent a few evenings working with my shiny new Apple, a color T.V. set, and the friendly Apple manuals, and quickly learned that things might not be very easy after all.

Apple's high resolution graphics mode consists of two areas or "pages" of memory in which to store the information that makes up a high resolution picture. The primary page picture buffer (or page 1) begins at memory location 8192 and extends up to location 16383, while the secondary page immediately follows, from locations 16384 to 24575. Six colors (black, white, green, violet, orange and blue) are available, although some limitations exist that I will talk more about later. Page one is mixture of graphics and text with four text lines residing beneath the graphics screen, although they can be removed by a simple POKE command. Page two is strictly graphics, with no text window easily available to the user. Basic statements can turn points on or off in color and can draw lines between a specified series of points. For those gamers in the crowd (like myself), binary shape tables can be created to draw, rotate, and expand a user defined shape anywhere on the screen. Sounds great, doesn't it? But let's backtrack for a moment.

To put it frankly, a single point plotted on the screen does not a picture make! A lot of careful thought and planning has to come before you can produce eye-catching drawings using this one-at-a-time method. Since many, many points must be used to produce a colorful drawing of, say, your friendly neighborhood computer, it becomes impractical (and very slow) to use a series of HPLLOT statements to draw it from within a program. Who'd want to figure out where all those points should go, anyway? The method used to create shape tables is very tedious and difficult; a single mistake can put you right back where you started from.

As a result, many would-be graphics artists have become frustrated with high-



resolution graphics and shy away from using them in their programs. The more affluent, of course, buy expensive graphics tablets costing hundreds of dollars, and produce visual effects to make the rest of us turn green with envy. I soon decided to even up the score a little bit; perhaps through a little software magic, it would become possible to duplicate some of the features of the graphics tablets.

---

***The method used  
to create shape tables  
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and difficult;  
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---

The result is my program, written in Applesoft to make life a little more enjoyable for the artistic Apple owner. With it you can create vivid computer art, without spending hundreds of dollars on an expensive graphics tablet, by using the Apple paddles for the drawing input. All six colors are available for either the actual drawing or for a change of background color; three pen sizes will produce thick strokes or fine detail. If you'd like to throw in some straight lines between any points on the screen, fine; and it's simple to selectively erase parts of a drawing, or the whole screen, instantly. None of this is going to do you much good if you can't preserve the results of your painstaking labor, so it is possible to save drawings on a disk and load them back into memory another time for viewing or modification. What

happens if you get stuck and can't remember how to erase the screen, or change color? Type control-H for help! and a page listing all the commands appears in place of the graphics screen; after perusing for a while, hit a key and the graphics screen is instantly restored, with any drawings intact.

When the program is run, a title page appears, followed by the command page after a key is pressed. As I said, you can pop right back here when in trouble by typing control-H. It's very helpful for beginners, but as you grow more experienced you won't be needing it anymore. Press another key and the real fun starts.

The text screen is now replaced by the black high resolution graphics screen, with a flashing white dot hiding somewhere about. If you doubt my word, turn the paddle knobs and it will magically dance across the screen. This is the point mode, as the first text line informs you, and pen position is indicated by that little blinking dot; it's color is white on a black screen and black on the others to improve visibility. To pop back into it when drawing, press P and the point will reappear. You can use it to carefully erase or chip away at parts of a drawing, or to jump quickly from place to place without drawing.

Ready to start a picture? Hit the W key and the dot stops flashing; by manipulating the paddle, you can produce a fine line of small white dots. Quickly move the pen to separate the dots, or draw slowly and carefully for a smooth white line. You can instantly change colors by pressing the first letter of the color desired (control-B for blue to differentiate it from B for black). It's just as easy to change pen size; press S and numerically choose small, medium, or large by pressing 1, 2 or 3. The point mode resumes, so press a color to begin drawing again in the new size. The pen will now be a small box instead of a single point, and a thicker line will result as you draw. Varying pen size within a drawing



# ALF/Apple Music Synthesizer

The ALF Apple Music Synthesizer (AMS) is an easy to use peripheral which allows you to program music into an Apple II computer using standard musical notation. The ALF kit includes the synthesizer board (plugs into any peripheral slot), exceptional quality software, and an extensive user manual.

## Sophisticated Music Entry Program

Sheet music is easily entered using the Apple game paddles. The high-resolution ENTRY program features the familiar music staff with a "menu" of musical items listed beneath it (note lengths, rests, edit commands, accidentals, etc.). One game paddle moves a cursor up and down the music staff and is used to select the note pitch; the second paddle chooses from the menu items (note length, etc.) With the ALF hi-res ENTRY program, you won't have to use cryptic codes to select note parameters.

As you program sheet music with ENTRY, measure bars are inserted automatically (and note values are tied over the bar where necessary). Key signatures are also automatic—you don't have to keep writing in every sharp or flat!

Three monophonic, individual parts can be programmed with each ALF Music Synthesizer. Two boards are required for stereo. A total of three synthesizers can be used simultaneously for a maximum of nine voices. By controlling the envelope (or shape) of each voice, many different instrumental sounds can be simulated.

## Eight-octave Range

The ALF Music Synthesizer has a pitch range of eight octaves—a wider range than a grand piano. The ALF can also play semitones—"blues notes" or the pitches in between the keyboard notes of a piano. (The pitch range is from 27.5 to 55,000 Hertz, well beyond the limits of human hearing.) Tuning accuracy is virtually perfect within two cents of pitch value.

Every parameter of the ENTRY program can be changed again and again during a musical piece. For example, you can make changes in key, time signature, volume, and timbre (envelope). Parts can be edited at any time, also. Notes can be added or deleted, note length can be changed, as well as pitch, volume, etc.

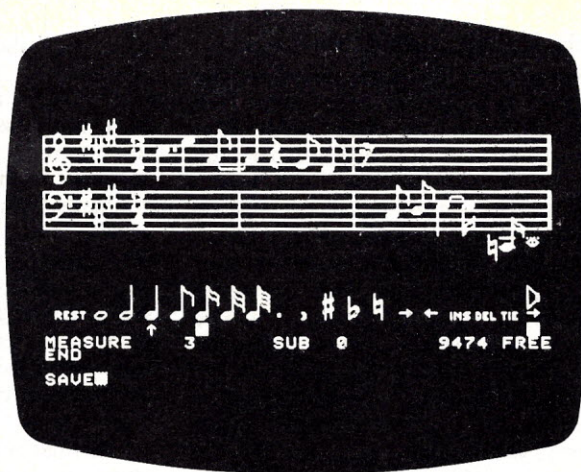
You can save songs on either cassette or disk, and play them back using either ENTRY or PLAY. The playback speed is adjusted with one of the game paddles, and can be varied during the playback, if you wish to change the overall tempo.

## Colorful Playback Display

The ALF Music Synthesizer features a 16-color low-res graphic display during song playback. Each musical part is represented on a stylized piano "keyboard"—the intensity of the note determines the color, and the pitch is shown in relation to "middle C".

The ALF Music Synthesizer requires the use of an external audio amplifier. Stereo programming is possible with the use of two or three synthesizer boards.

The ALF software includes the ENTRY and PLAY programs, sample songs, an introduction to "envelope shaping", and demonstrations of advanced uses of the synthesizer.



*With the ALF software, entry of music is easy, fast and accurate.*

## Nine Voices for only \$198

The new ALF "AM-II" music synthesizer offers an unbeatable value for the Apple owner who is a music hobbyist. With nine voices on a single music board for \$198.00, the AM-II is the most economical device for creating music with the Apple.

The AM-II uses the same excellent ENTRY and PLAY programs as the more sophisticated ALF Music Synthesizer (AMS); the same hi-res graphic display from which notes are selected with the Apple game paddles (not typed with cryptic codes). All of the conveniences of the ENTRY program apply—easy editing, playback with low-res display, ability to save songs on cassette or disk, etc.

The AM-II has **stereo output** (3 voices in left, 3 voices in the middle, 3 voices in the right).

How can the AM-II offer so much for only \$198.00? The two basic differences between the AM-II and the ALF Apple Music Synthesizer (AMS) are pitch accuracy and dynamic range. The AM-II has an accurate pitch range of about six octaves. Pitch values above the treble staff become increasingly inaccurate. Also, the AM-II has a dynamic range of 28db, with 16 different volume levels, (the AMS has a dynamic range of 78db).

The AM-II is manufactured with the same high quality standards as other products from the ALF Corporation. No sacrifice has been made in reliability; the new AM-II is simply a great bargain.

Professional musicians will still want to use the original Apple Music Synthesizer (AMS) for its extended range and volume controls (the AMS has a range of 8 octaves). But for the Apple owner who is interested in music as a hobby, the AM-II is the best music peripheral value available today.

Requires: 16K Apple II or Apple II Plus, cassette or Disk II, and an external audio amplifier (all necessary patch cords are included).

AM-II ALF/Apple Synthesizer	\$198.00
AMS ALF/Apple Synthesizer	268.00

To order, send payment plus \$3.00 shipping and handling to Peripherals Plus, 119 Maple Ave., Morristown, NJ 07960. Credit card customers should include card number and expiration date of Visa, MasterCard or American Express. Credit card customers may also order toll-free:

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## Apple Sketch, continued...

will produce more pleasing results, so use all three to spice up your work. The largest size, by the way, will quickly color in large areas of a picture, such as the sky.

But suppose you'd rather draw black on a white background, or blue on an orange background? No problem! Press X and then the number of the new background color you want; the screen will be instantly filled with that color, and you'll be returned to the point mode. In the process, everything on the screen is erased, so if you hit X by mistake, "return" will get you back to the point mode, safe and sound!

I'm sure that the first few attempts at a drawing will result in a meaningless clutter on the screen; it takes a lot of practice to draw easily with the paddles. By typing control-W, you can erase the whole screen instantly and start over again for (hopefully!) better results. Or you can selectively erase parts of a drawing, either by using the point or with the special erase mode. Press E and a large, blinking square will appear in place of the pen; move it carefully around to erase more quickly than with the point. The eraser is easier to locate than the point, being larger and more visible, so it could also be called a kind of extended point mode.

The line drawing mode can be used to quickly draw straight, even lines between any two points on the screen; a line is drawn in the last pen color used, and its thickness corresponds to the current pen size. After L is pressed, the flashing point reappears on the screen, and its changing X-Y coordinates are continuously displayed in the text window. To set the first endpoint, hit a key; the point will be plotted, followed by a brief pause so that the pen can be moved away. Then the flashing dot reappears, and the second endpoint can be set in the same way. The program asks if there are any corrections, and if the endpoints are exactly where you want them, depress N to draw the line and return to the point mode. Pressing Y gives the option of changing either or both of the endpoints; hit 1 to change point #1, 2 to change point #2, or B to change both. Hitting "return" when in the line drawing mode returns you to the point mode.

Okay, so now you have a great picture done that you want to show your family and friends; how can it be saved? Type control-S and enter the name you'd like it to be stored under; this name should begin with a letter, not a number or control character, although these can be used after the first letter. Hit "return", and the contents of the entire high resolution screen will be saved in a binary file on the disk. Be careful, because an unlocked file with the same name will be erased and written over! If you change

your mind about saving, hit "return" to reenter the point mode. The same process holds true for the load command (control-L), but instead of saving, a high resolution picture will be loaded into memory from the specified disk file, gradually filling the graphics screen and erasing anything previously displayed. One important note here: if you load a picture with a colored background, make sure you change the screen to the correct color first. Otherwise, the point mode will start erasing the background, as it might previously have been set for a black screen.

The final command is control-E, and it allows for a graceful, dignified exit from the program, after giving you one last chance to reconsider. More violent types will, I'm sure, use control-C or even (ugh!) reset; make your choice accordingly. And now, for the program itself:

Line 5 resets LOMEM: to 16384, above the primary page of high resolution graphics. While I was entering the program, I painfully discovered that as it

---

***You can instantly  
change colors  
by pressing the  
first letter of the  
color desired.***

---

grew, it extended upward above location 8192 and into the primary high resolution page, causing the random lines to appear on the graphics screen. The last few lines of the program also acquired bad habits, playing hide and seek with me when more was added to the program. All very unpleasant, but the first line magically cures the problem. Incidentally, LOMEM: is reset to its normal value (just above 2000 with firmware Applesoft), by NEW, DEL, and by adding or changing a program line.

Lines 10-50 print the title page, wait for a key to be pressed, clear the keyboard strobe, and go to subroutine 1000, which prints out the command page.

Line 90 traps for an error that might occur during the program run; without it, the program would bomb out, and you would probably lose your picture. It sends program flow to subroutine 4000, where the error is appropriately processed.

Line 100 is initialization; it sets point and screen color, pen size, drawing modes, and D\$ as Control-D for DOS commands. It clears the text screen and initializes the high resolution display; then line 105 pops the cursor down to the 21st line directly below the graphics screen and goes to subroutine 650, which

handles the point mode and pen size display.

Lines 100-200 handle the drawing, depending on the present program mode and pen size. If a key is pressed, line 110 goes to subroutine 300, which handles commands. Lines 120 and 130 read the two paddles for the X and Y pen position. If the point mode is true, line 140 plots at the present position, erases, resets the color and returns to line 110. Lines 150 and 160 draw a medium and large box in the present color, depending on pen size, if the erase mode is off. If the eraser is on, lines 170 and 180 set its color, depending on the present screen color, and 190 draws and erases it. If none of the above are true, line 200 plots the point and returns to line 110.

The following are program subroutines that are used when commands are input from the keyboard:

Lines 300-385 process commands, calling other subroutines in the process and finally returning to the main drawing section. Line 300 gets the character pressed from the keyboard and clears the keyboard strobe. The remaining lines change colors or modes, or call other subroutines if necessary, depending on the command that has been entered. If the key pressed is not a command, line 385 returns to the main drawing section.

Lines 500-530 save a picture on disk; line 520 alerts DOS with previously initialized D\$ and BSAVES the entire memory contents of high resolution page 1 under the file name input in line 510. A\$2000 specifies the starting hexadecimal address (8192 decimal) and L\$2000 specifies the length of the area of memory to be stored. Lines 600-630 are used in the same way to load a picture from disk into memory starting at hex location 2000, the beginning of the primary page.

Lines 650-660 set the color of the point for the point mode, depending on the present screen color. Line 660 clears the text window, sets and prints the point mode, goes to subroutine 3000 where the pen size is displayed, and returns.

Lines 700-730 are reached by control-E, and provide a dignified exit from the program. As I said before, killjoys may use "reset" or control-C if they wish.

Lines 800-840 print out the numbers for the different colors and get a character response. "Return" or CHR\$(13) pops you back into the drawing routine after resetting the point mode; an incorrect response causes line 815 to get another character. Otherwise, line 830 sets the new screen color, plots a point, and calls the special machine language routine 62454 to clear the screen in the last color HPLoTted. Finally, line 840 goes to subroutine 650, which handles the point mode restoration and pen size display.

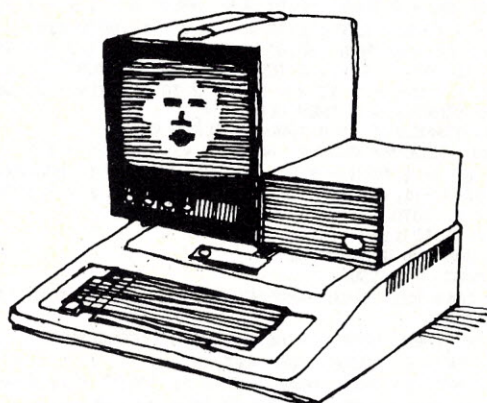
Lines 900-940 use the same method to get a new pen size; a valid response resets



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CIRCLE 226 ON READER SERVICE CARD



## Apple Sketch, continued...

```

PRINT "80      "
JLIST
5 LOMEM: 16384
10 HOME : VTAB 10: HTAB 7: PRINT "***      APPLE-SKETCH      ***": PRINT
20 HTAB 13: PRINT "BY DAVID MILLER"
30 VTAB 19: HTAB 11: PRINT "HIT ANY KEY TO BEGIN"
40 IF PEEK (- 16384) < = 127 THEN 40
50 POKE - 16384,0: GOSUB 1000
90 ONERR GOTO 4000
100 HOME : HGR :OLDCLR = 3: HCOLOR = 3:SCRNCLR = 0:PNT = 1:ER = 0:SML = 1:
    MED = 0:LRG = 0:D$ = CHR$ (4)
105 VTAB 21: GOSUB 650
110 IF PEEK (- 16384) > 127 THEN GOSUB 300
120 X = PDL (1) * 1.21 + 2: IF X > 277 THEN X = 277
130 Y = PDL (0) + 2: IF Y > 157 THEN Y = 157
140 IF PNT THEN HPLT X,Y: HCOLOR= SCRNCLR: HPLT X,Y: HCOLOR= OLDCLR: GOTO
    110
150 IF MED AND ER = 0 THEN HPLT X,Y: HPLT X - 1,Y - 1 TO X + 1,Y - 1 TO
    X + 1,Y + 1 TO X - 1,Y + 1 TO X - 1,Y - 1: GOTO 110
160 IF LRG AND ER = 0 THEN HPLT X,Y: HPLT X - 1,Y - 1 TO X + 1,Y - 1 TO
    X + 1,Y + 1 TO X - 1,Y + 1 TO X - 1,Y - 1: HPLT X - 2,Y - 2 TO X + 2
    ,Y - 2 TO X + 2,Y + 2 TO X - 2,Y + 2 TO X - 2,Y - 2: GOTO 110
170 IF ER AND SCRNCLR = 0 THEN OLDCLR = 3
180 IF ER AND SCRNCLR < > 0 THEN OLDCLR = 0
190 IF ER THEN HCOLOR= OLDCLR: HPLT X,Y: HPLT X - 1,Y - 1 TO X + 1,Y -
    1 TO X + 1,Y + 1 TO X - 1,Y + 1 TO X - 1,Y - 1: HCOLOR= SCRNCLR: HPLT
    X,Y: HPLT X - 1,Y - 1 TO X + 1,Y - 1 TO X + 1,Y + 1 TO X - 1,Y + 1 TO
    X - 1,Y - 1: GOTO 110
200 HPLT X,Y: GOTO 110
299 REM *** COMMAND SUBROUTINE
300 GET A$: POKE - 16384,0
305 IF A$ = CHR$ (23) THEN HCOLOR= SCRNCLR: HPLT 0,0: CALL 62454: HCOLOR=
    OLDCLR: RETURN
310 IF A$ = "W" THEN HOME : VTAB 21: PRINT "COLOR=WHITE":OLDCLR = 3: HCOLOR=
    3:PNT = 0:ER = 0: GOSUB 3000: RETURN
315 IF A$ = CHR$ (2) THEN HOME : VTAB 21: PRINT "COLOR=BLUE":OLDCLR = 6
    : HCOLOR= 6:PNT = 0:ER = 0: GOSUB 3000: RETURN
320 IF A$ = "G" THEN HOME : VTAB 21: PRINT "COLOR=GREEN":OLDCLR = 1: HCOLOR=
    1:PNT = 0:ER = 0: GOSUB 3000: RETURN
325 IF A$ = "E" THEN HOME : VTAB 21: PRINT "ERASE MODE":PNT = 0:ER = 1: RETURN
330 IF A$ = "V" THEN HOME : VTAB 21: PRINT "COLOR=VIOLET":OLDCLR = 2: HCOLOR=
    2:PNT = 0:ER = 0: GOSUB 3000: RETURN
335 IF A$ = "O" THEN HOME : VTAB 21: PRINT "COLOR=ORANGE":OLDCLR = 5: HCOLOR=
    5:PNT = 0:ER = 0: GOSUB 3000: RETURN
340 IF A$ = "B" THEN HOME : VTAB 21: PRINT "COLOR=BLACK":OLDCLR = 0: HCOLOR=
    0:PNT = 0:ER = 0: GOSUB 3000: RETURN
345 IF A$ = CHR$ (12) THEN HOME : VTAB 21: GOSUB 600: RETURN
350 IF A$ = "S" THEN HOME : VTAB 21: GOSUB 900: RETURN
355 IF A$ = "P" THEN HOME : VTAB 21: GOSUB 650: RETURN
360 IF A$ = CHR$ (8) THEN GOSUB 1000: GOSUB 650: RETURN
365 IF A$ = CHR$ (19) THEN HOME : VTAB 21: GOSUB 500: RETURN
370 IF A$ = "L" THEN GOSUB 2000: RETURN
375 IF A$ = "X" THEN GOSUB 800
380 IF A$ = CHR$ (5) THEN GOSUB 700
385 RETURN
500 REM *** SAVE PICTURE
510 PRINT "READY TO SAVE PICTURE "; INVERSE : PRINT "RETURN": NORMAL
    : PRINT " TO EXIT": INPUT "PICTURE NAME ? ":PICTURE$
515 IF PICTURE$ = "" THEN GOSUB 650: RETURN
520 PRINT D$:"BSAVE ";PICTURE$," ",A$2000,L$2000"
530 PRINT PICTURE$," SAVED. ": FOR I = 1 TO 3000: NEXT I: GOSUB 650: RETURN
600 REM *** LOAD PICTURE
610 PRINT "READY TO LOAD PICTURE "; INVERSE : PRINT "RETURN": NORMAL
    : PRINT " TO EXIT": INPUT "PICTURE NAME ? ":PICTURE$
615 IF PICTURE$ = "" THEN GOSUB 650: RETURN
620 PRINT D$:"BLOAD ";PICTURE$," ",A$2000"
630 PRINT PICTURE$," LOADED. ": FOR I = 1 TO 3000: NEXT I: GOSUB 650: RETURN
640 REM *** SET POINT MODE COLOR
650 IF SCRNCLR = 0 THEN OLDCLR = 3: GOTO 660
655 OLDCLR = 0
660 HCOLOR= OLDCLR:PNT = 1: HOME : VTAB 21: PRINT "POINT MODE": GOSUB 300
    0: RETURN
669 REM *** CTRL-E EXIT PROGRAM?
700 HOME : VTAB 21: PRINT "REALLY EXIT THE PROGRAM (Y/N) ? ":
705 GET A$
710 IF A$ = "Y" THEN TEXT : HOME : GOTO 4100
720 IF A$ = "N" THEN GOSUB 650: RETURN
730 GOTO 705
799 REM *** CHANGE BACKGROUND COLOR
800 HOME : VTAB 21: PRINT "BLACK-0 GREEN-1 VIOLET-2 WHITE-3": PRINT
    "ORANGE-5 BLUE-6 "; INVERSE : PRINT "RETURN": NORMAL : PRINT "
    TO EXIT"
810 PRINT "NEW BACKGROUND COLOR # ":
815 GET Z$: IF Z$ = CHR$ (13) THEN 840
820 IF ASC (Z$) < 48 OR ASC (Z$) > 54 OR Z$ = "4" THEN 815
830 SCRNCLR = VAL (Z$): HCOLOR= SCRNCLR: HPLT 0,0: CALL 62454: HCOLOR= 0
    LDCLR

```

pen size and goes to subroutine 650, which handles point mode and pen size display. An incorrect response causes line 905 to get another character.

Lines 1000-1210 display the command page. Line 1000 puts the screen back into the text mode and clears it; after the commands are printed, line 1200 waits for a key to be pressed. Then 1210 clears the keyboard strobe and uses POKE-16304,0 to restore the high resolution graphics screen without clearing it to black (which is what another HGR command would do).

Lines 2000-2470 handle the line drawing, displaying the X and Y coordinates for each point and HPLOTting the lines. Lines 2060 and 2070 read the paddles for point #1, and 2190 and 2200 read them for point #2.

Lines 3000-3030 check for the current pen size and display it beneath the lower right of the graphics screen.

Finally, lines 4000-4070 handle any DOS errors that might occur when loading or saving pictures. Line 4010 sets A to the Apple error code for the trapped

***It takes a lot  
of practice to draw  
easily with the paddles.***

error, which is stored in decimal location 222; it also sets B equal to the line that the error occurred on. Then it clears the text screen and tabs down to the top of the text window, ready to print a message based on the error. The lines after handle:

1. Attempts to load a picture not on disk (DOS "file not found" error).
2. Attempts to save on a write protected disk, such as the DOS master or one with a write protect tab covered.
3. An I/O error, usually encountered when the disk drive door is left open.
4. Attempts to save on a filled disk, or with too little space left to hold the picture.
5. Attempts to save under a file name on disk that is locked.
6. The use of an illegal file name, usually beginning with a number or a control character.
7. Attempts to load a Basic or text file as a picture (believe me, that just won't work!)
8. Control-C: returns the text mode and ends.

As far as I can see, those are the only errors that would normally occur when running the program; all other input is handled by GET and thrown out if inappropriate. If all else fails, line 4060 tells you what error occurred and where before stopping the program. Before



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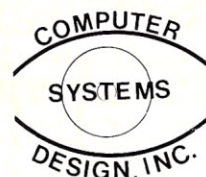
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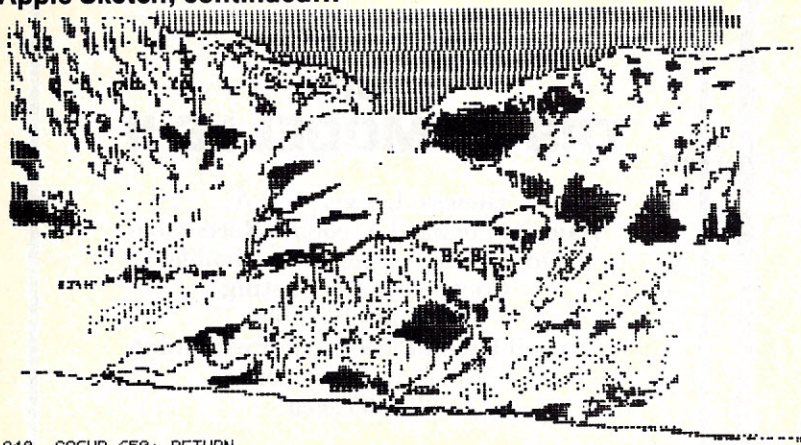
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## Apple Sketch, continued...



```

840 GOSUB 650: RETURN
899 REM *** CHANGE PEN SIZE
900 PRINT "READY TO CHANGE PEN SIZE": PRINT "SMALL(1) - MEDIUM(2) - LARGE
(3) ?";
905 GET A$
910 IF A$ = "1" THEN SML = 1: MED = 0: LRG = 0: GOSUB 650: RETURN
920 IF A$ = "2" THEN SML = 0: MED = 1: LRG = 0: GOSUB 650: RETURN
930 IF A$ = "3" THEN SML = 0: MED = 0: LRG = 1: GOSUB 650: RETURN
940 GOTO 905
999 REM *** COMMAND PAGE
1000 TEXT : HOME : HTAB 6: PRINT "*** LIST OF COMMANDS ***": PRINT : PRINT
1010 INVERSE : PRINT "CTRL": NORMAL : PRINT " B - SETS DRAWING COLOR TO
BLUE"
1020 PRINT TAB( 6); "W - SETS DRAWING COLOR TO WHITE"
1030 PRINT TAB( 6); "B - SETS DRAWING COLOR TO BLACK"
1040 PRINT TAB( 6); "O - SETS DRAWING COLOR TO ORANGE"
1050 PRINT TAB( 6); "G - SETS DRAWING COLOR TO GREEN"
1060 PRINT TAB( 6); "V - SETS DRAWING COLOR TO VIOLET"
1070 PRINT
1080 PRINT TAB( 6); "P - CHANGES TO POINT MODE"
1090 PRINT TAB( 6); "E - CHANGES TO ERASE MODE"
1100 PRINT TAB( 6); "L - CHANGES TO LINE DRAWING MODE"
1110 PRINT TAB( 6); "X - CHANGES BACKGROUND COLOR"
1120 PRINT TAB( 6); "S - CHANGES PEN DRAWING SIZE"
1130 PRINT
1140 INVERSE : PRINT "CTRL": NORMAL : PRINT " W - WIPE SCREEN CLEAR, STA
RT OVER"
1150 INVERSE : PRINT "CTRL": NORMAL : PRINT " S - SAVE CURRENT PICTURE O
N DISK"
1160 INVERSE : PRINT "CTRL": NORMAL : PRINT " L - LOAD PICTURE FROM DISK
"
1170 INVERSE : PRINT "CTRL": NORMAL : PRINT " H - DISPLAY THIS PAGE OF C
OMMANDS"
1180 INVERSE : PRINT "CTRL": NORMAL : PRINT " E - EXIT THE PROGRAM"
1190 PRINT : PRINT TAB( 6); "HIT ANY KEY WHEN READY..."
1200 IF PEEK ( - 16384) > 127 THEN 1200
1210 POKE - 16368, 0: POKE - 16304, 0: RETURN
2000 REM *** DRAW LINE
2010 LINE$ = " "
2020 CH = 0: X1 = 0: X2 = 0: Y1 = 0: Y2 = 0: QX = 0: QY = 0
2030 HOME : VTAB 21: PRINT "LINE DRAWING MODE " : INVERSE : PRINT
"RETURN": NORMAL : PRINT " TO EXIT"
2040 VTAB 22: PRINT "POINT #1: X= Y= <HIT KEY TO SET"
2050 IF PEEK ( - 16384) > 127 THEN GET A$: POKE - 16368, 0: VTAB 22: HTAB
25: PRINT LINE$: QX = X1: QY = Y1: GOSUB 2430: GOTO 2150
2060 X1 = PDL (1) * 1.21 + 2: IF X1 > 277 THEN X1 = 277
2070 Y1 = PDL (0) + 2: IF Y1 > 157 THEN Y1 = 157
2075 VTAB 22: HTAB 13: PRINT INT (X1);
2080 IF X1 < 10 THEN PRINT " "
2090 IF X1 > = 10 AND X1 < 100 THEN PRINT " "
2100 IF X1 > = 100 THEN PRINT " "
2105 VTAB 22: HTAB 20: PRINT INT (Y1);
2110 IF Y1 < 10 THEN PRINT " "
2120 IF Y1 > = 10 AND Y1 < 100 THEN PRINT " "
2130 IF Y1 > = 100 THEN PRINT " "
2140 HCOLOR= OLDCLR: HPLT X1, Y1: HCOLOR= SCRNCLE: HPLT X1, Y1: GOTO 2050
2150 IF CH = 1 THEN 2290
2160 IF A$ = CHR$ (13) THEN 2300
2170 VTAB 23: PRINT "POINT #2: X= Y= <HIT KEY TO SET"
2180 IF PEEK ( - 16384) > 127 THEN GET A$: POKE - 16368, 0: VTAB 23: HTAB
25: PRINT LINE$: QX = X2: QY = Y2: GOSUB 2430: GOTO 2280
2190 X2 = PDL (1) * 1.21 + 2: IF X2 > 277 THEN X2 = 277
2200 Y2 = PDL (0) + 2: IF Y2 > 157 THEN Y2 = 157
2205 VTAB 23: HTAB 13: PRINT INT (X2);
2210 IF X2 < 10 THEN PRINT " "
2220 IF X2 > = 10 AND X2 < 100 THEN PRINT " "
2230 IF X2 > = 100 THEN PRINT " "
2235 VTAB 23: HTAB 20: PRINT INT (Y2);
2240 IF Y2 < 10 THEN PRINT " "

```

running the program, I suggest taking a CATALOG of the disk to see what pictures are available, and which are locked (it would be a good idea to lock an important picture to prevent accidental erasure). Since you won't be able to save onto a locked file name, you'd have to save under another name to preserve your present version without losing the program.

Once a picture has been saved on disk, it can be recalled from a Basic program and displayed using the same technique as in subroutine 600. The program should initialize the string D\$ as control-D or CHR\$(4), then set the primary page of high resolution graphics and load the picture into memory using DOS commands.

There are a few limitations to what you can do with this program. One problem arises in that the Apple paddles are not very sturdy and tend to become worn with usage. Theoretically, they should produce a steady stream of values from 0 to 255. When new, yes. After a few weeks of Space Invaders and assorted other

***If all else fails,  
line 4060 tells you  
what error occurred.***

paddle games, no. Presently, my PDL(O) only goes up to about 180, and PDL(1) to 225. As a result, I use PDL(O) for the Y input, which only has to go to about 160. Unfortunately, the screen is 280 units wide, so my PDL(1) values have to be multiplied to make the pen cover the entire screen, and in the process, some values are lost. With multiplication, I've discovered that about two out of every ten X values just cannot be produced, and it becomes impossible to draw a perfectly smooth line in the X direction. Is there a solution to the problem?

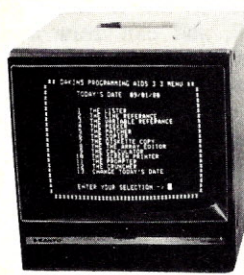
Yes, even if only a partial one, and I suggest it for those who type in this program. The first step is to find out just how your particular paddles will go. Change lines 2060 and 2070 to X1=PDL(1) and Y1=PDL(O). Then enter the line drawing mode and move your paddles clockwise from zero to the highest possible values. Say your paddles are functioning perfectly, and PDL(1) stops at 255. You *can* use the paddle values without multiplying if you leave a small margin on either side of the page. For a perfect paddle, subtract 255 from 280 and divide by 2, leaving a margin of 12.5 on each side. Let's call it 12, and change line 2060 to read:

```

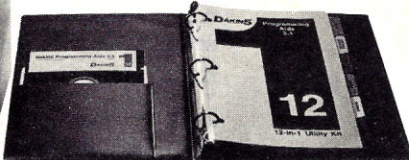
2060 X1=PDL(1)+12:IF X1> 277
THEN X1=277

```





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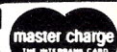
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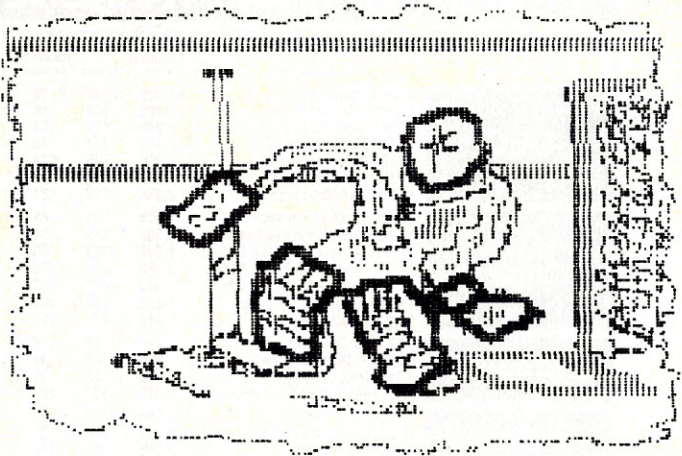
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## Apple Sketch, continued...



```

2250 IF Y2 > = 10 AND Y2 < 100 THEN PRINT " "
2260 IF Y2 > = 100 THEN PRINT " "
2270 HCOLOR= OLDCLR: HPLLOT X2,Y2: HCOLOR= SCRNCLR: HPLLOT X2,Y2: GOTO 2180
2280 IF A$ = CHR$(13) THEN 2300
2290 VTAB 21: HTAB 1: PRINT "ANY CORRECTIONS ? ";
2295 GET A$
2300 IF A$ = CHR$(13) THEN HCOLOR= SCRNCLR: HPLLOT X1,Y1: HPLLOT X2,Y2: HCOLOR
= OLDCLR: GOTO 2460
2310 IF A$ = "Y" THEN 2360
2320 IF A$ = "N" AND SML THEN HPLLOT X1,Y1 TO X2,Y2: GOTO 2450
2330 IF A$ = "N" AND MED THEN FOR I = - 1 TO 1: HPLLOT X1 + I,Y1 + I TO
X2 + I,Y2 + I: NEXT I: GOTO 2450
2340 IF A$ = "N" AND LRG THEN FOR I = - 2 TO 2: HPLLOT X1 + I,Y1 + I TO
X2 + I,Y2 + I: NEXT I: GOTO 2450
2350 GOTO 2295
2360 VTAB 21: HTAB 1: PRINT LINE$; " ": VTAB 21: HTAB 1: PRINT "POINT 1,
2, OR BOTH ?";
2370 GET A$
2380 IF A$ = CHR$(13) THEN 2300
2390 IF A$ = "1" THEN CH = 1: GOSUB 2470: HPLLOT X1,Y1: HCOLOR= OLDCLR: GOTO
2040
2400 IF A$ = "2" THEN CH = 2: GOSUB 2470: HPLLOT X2,Y2: HCOLOR= OLDCLR: GOTO
2170
2410 IF A$ = "B" THEN CH = 0: GOSUB 2470: HPLLOT X1,Y1: HPLLOT X2,Y2: HCOLOR=
OLDCLR: GOTO 2040
2420 GOTO 2370
2430 IF A$ = CHR$(13) THEN RETURN
2440 HCOLOR= OLDCLR: HPLLOT QX,QY: FOR I = 1 TO 500: NEXT I: RETURN
2450 HOME : VTAB 21: PRINT "DONE...": FOR I = 1 TO 1000: NEXT I
2460 GOSUB 650: RETURN
2470 VTAB 21: HTAB 1: PRINT LINE$; " ": VTAB 21: HTAB 1: PRINT "LINE D
RAWING MODE": HCOLOR= SCRNCLR: RETURN
2999 REM *** PEN SIZE DISPLAY
3000 VTAB 21: HTAB 25: PRINT "PEN SIZE=";
3010 IF SML THEN PRINT "SMALL ": RETURN
3020 IF MED THEN PRINT "MEDIUM": RETURN
3030 IF LRG THEN PRINT "LARGE ": RETURN
4000 REM *** ERROR TRAPPING
4010 A = PEEK (222): B = PEEK (218) + PEEK (219) * 256: HOME : VTAB 21
4020 IF A = 6 THEN PRINT "YOU DON'T HAVE THAT PICTURE ON DISK...": GOTO
4070
4025 IF A = 4 THEN PRINT "YOUR DISK IS WRITE PROTECTED !": PRINT "USE AN
OTHER OR REMOVE WRITE PROTECT TAB. ": GOTO 4070
4030 IF A = 8 THEN PRINT "I/O ERROR... IS YOUR DISK DRIVE OPEN ?": PRINT
"IF NOT, TRY AGAIN OR USE ANOTHER DISK. ": GOTO 4070
4035 IF A = 9 THEN PRINT "TOO MANY FILES ON DISK; DELETE SOME": PRINT "O
R USE ANOTHER DISK. ": GOTO 4070
4040 IF A = 10 THEN PRINT "THAT DISK FILE IS LOCKED... UNLOCK IT": PRINT
"OR USE ANOTHER NAME FOR YOUR PICTURE. ": GOTO 4070
4045 IF A = 11 THEN PRINT "ILLEGAL FILE NAME. ": PRINT "PLEASE BEGIN WITH
A LETTER. ": GOTO 4070
4050 IF A = 13 THEN PRINT "THAT FILE IS NOT A PICTURE...": GOTO 4070
4055 IF A = 255 THEN TEXT : HOME : GOTO 4100
4060 PRINT "PROGRAM TERMINATED DUE TO ERROR ";A: PRINT "LINE # ";B: GOTO
4100
4070 FOR I = 1 TO 3000: NEXT I: GOSUB 650: GOTO 110
4100 TEXT : END

```



Now you can get *all* of the X values between 12 and 267, and can draw a perfectly smooth line. You *won't* be able to go outside of those two margins, but they are really very small and I believe the sacrifice is worth it. Likewise, change lines 120 and 2190 to read:

```
120 X=PDL(1)+12:IF X>277 THEN X=277
```

```
2190 X2=PDL(1)+12:IF X2>277
THEN X2=277
```

I've altered my version in the same way; as my paddle goes to 225, I add 27 to the PDL(1) values and lose a somewhat larger margin. It's all up to your personal preference; remember, these are very inexpensive input devices and it's going to take a little experimentation to get them working just right.

I'd also like to warn you that certain colors will not draw cleanly on colored backgrounds, due to the way the high resolution display works. Drawing black on an orange background, for example, produces ragged green fringes, which may also appear when erasing orange on

***The fringe effects  
may be just what  
you want to produce  
a dazzling, modernistic  
picture.***

another background. These color fringes appear mainly when using the colored backgrounds. They don't seem to be a problem when drawing on black or white. Consequently, I'd advise drawing on either black or white; if you'd like large areas of another color, switch to the large pen and color them in. Of course, the fringe effects may be just what you want to produce a dazzling, modernistic picture.

Don't forget, graphics tablets cost money for a good reason: they are very fast, accurate, and sophisticated. A simple Basic program, such as mine, is hard put to match their performance using very inexpensive paddles as input devices. It can, however, provide a creative challenge and hours of plain old fun if the user has just a little patience and self control (please try not to offend or abuse your poor machine in any way). I can't promise miracles, but believe me, you *can* draw good pictures if you use some imagination and creativity. I know, because I've done some myself that I like very much! Inevitably, some people just won't be able to get the knack of drawing with the paddles, no matter how hard they try. Ah well, they can always go back to playing Space Invaders.... □

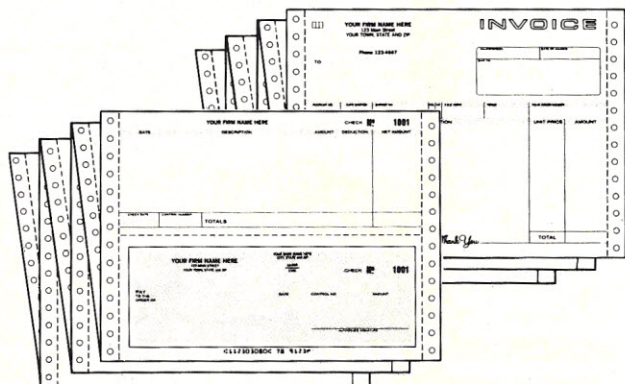


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# Apple II Lo-Res Shape Tables

David Lubar

Drawing a complex shape in Lo-Res graphics requires a large number of PLOT, HLIN, and VLIN statements. Getting such a shape to move on the screen can be a slow process. While each square is drawn quickly, time is lost since the process involves interpreting the Basic command, jumping to the monitor, returning the Basic, and so on. In such cases, a Lo-Res shape table subroutine could be useful. The following article describes such a program, designed for use with Integer Basic.

I attempted to follow, to a degree, the format of Hi-Res shape tables, while eliminating some of the more difficult aspects of such tables.

## What is a Shape Table?

A shape table is just a series of instructions which are represented as numbers. In this case, the numbers contain two types of information: 1) Whether or not to plot a square at the present location; 2) Where to move next. With this information, any shape can be defined, as long as it fits within the limits of the screen. There are eight possible directions to move in the Lo-Res routine (see figure 1.) Combined with the plotting options, this gives 16 different commands. Since the Apple's monitor uses hexadecimal data, and since there are two hex digits in a byte, each byte can contain two table entries. To further simplify plotting, the table is constructed without an index. This restricts the entire table to 256 bytes, which isn't much of a limitation.

## Making a Table

Each table must begin with a \$00 (the "\$" signifies that the number is in hex.) The end of each shape within the table is also marked with a \$00. As in Hi-Res, you can't move up twice without plotting. But, since diagonal moves are allowed,

you can get there by going diagonally left and up, then diagonally right and up.

Starting at the top, the values of the moves go clockwise from 0 to 7 (figure 1.) If the point is to be plotted, 8 is added to the value. Once all the values for a shape have been calculated, they are put in pairs. The routine reads each byte from right to left, so the first command of each pair should be the lower digit of the byte. For example, if the first command has a value of "8" and the second a value of "F", the table entry would be "F8". (For those who aren't familiar with hex, the values "10" through "15" are represented as "A" through "F".) Figure 2 illustrates the process of assembling a shape table.

**With this information,  
any shape can  
be defined,  
as long as it fits  
within the limits  
of the screen.**

## Using the Program

Since the routine takes values from the variable table, certain variables have to be defined first. This is done with:

10 X0=Y0=SHAPE

Any variables can be used, as long as they are the same length as the ones shown above. Whenever you want to draw a shape from the table, define X0 for the X coordinate, Y0 for the Y coordinate, and SHAPE for the desired shape. The draw is done with CALL 4353. After this, X0 and Y0 will have whatever values the last move assigned to them. To draw

the shape elsewhere, X0 and Y0 must be redefined.

The table begins at location \$1000, and can go up to \$10FF. The routine lies directly above this point. That leaves 2K for the Basic variable table. Some refinements could be added to the program, such as error checks to make sure the squares are plotted within screen limits. If desired, a scale function could be added.

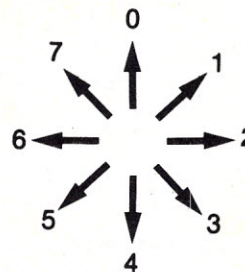


Figure 1.  
Plotting Vectors

Direction	No Plot		Plot	
	Binary	Hex	Binary	Hex
↑	0000	0	1000	8
↗	0001	1	1001	9
→	0010	2	1010	A
↘	0011	3	1011	B
↓	0100	4	1100	C
↙	0101	5	1101	D
←	0110	6	1110	E
↖	0111	7	1111	F

## Putting it all Together

The routine can be appended to an Integer Basic program in a number of ways. It can be loaded separately, it can be loaded with the program if the pointers are first reset, or it can be POKed from Basic as explained in "The Apple Cart" column (*Creative Computing*, March 1980.) The table can also be POKed from basic, or loaded in together with the routine.

If you are unfamiliar with machine lan-

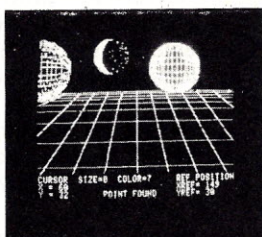


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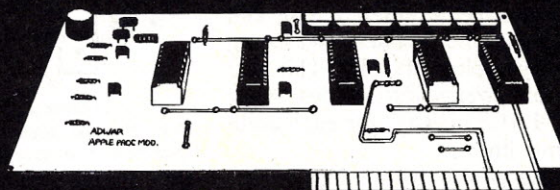
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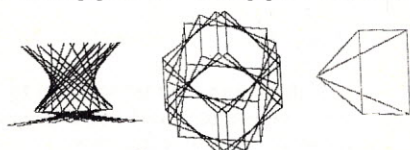
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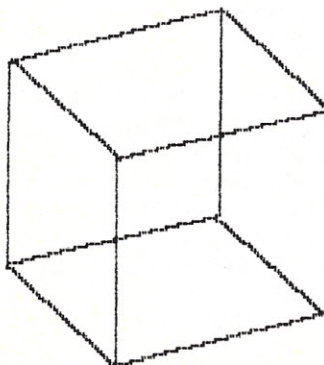


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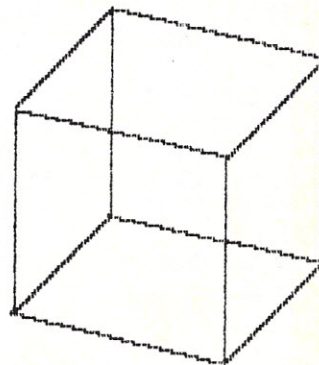
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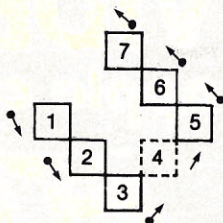


## Lo-Res, continued...

guage, there is an easy way to enter the routine into memory. Just go into the monitor, type "1100:" followed by the bytes shown in the hex dump (Figure 4.) Only the first memory location has to be entered. After that, whenever you hit RETURN, type another colon before beginning the next row of bytes. Once the whole routine is entered, you can check it against the disassembled listing (Figure 3) by typing "1100L". This will show the first twenty instructions. After this, type "L (RETURN)" for each additional twenty lines.

The listing shown by the Apple will contain the commands that are in the

second column of Figure 3. The third column will be represented on the screen as numbers instead of the labels shown.



1	=	1011	=	B
2	=	1011	=	B
3	=	1001	=	9
4	=	0001	=	1
5	=	1111	=	F
6	=	1111	=	F
7	=	1111	=	F

Figure 2: Sample Table Entry

Note: For last square plotted, direction of move after plot is arbitrary. Also, if there are an odd number of nybbles, the last one is completed with a 0 in the hi position.

Figure 3

These can be checked by using the symbol table at the top of Figure 3.

## Practical Considerations

If a program uses very simple shapes, this routine isn't necessary. But, when you want to quickly draw and move a complicated shape, such as a person or a large spaceship, you'll find that the Lo-Res Shape Table routine allows much quicker animation than is possible in Basic. It also requires fewer program statements. Finally, as a bonus, it simplifies the creation of shapes. You don't have to worry about coordinates. All you need to know is which direction you want to move and whether you want a square at that location.

**When you want to quickly draw and move a complicated shape, such as a person or a large spaceship, you'll find that the Lo-Res Shape Table routine allows much quicker animation than is possible in Basic.**

## How it Works

This section can be skipped by anyone who prefers to avoid the company of bit hackers and other fanatics.

First, Y is loaded with the number of the shape. The routine steps through the table, decrementing Y whenever a \$00 is found. When Y=0, the desired shape has been located. Each byte of the table is put in the A register, and a check is made to see if the shape is done. If not, the byte is pushed onto the stack. An AND #F gets the lo nybble. If the hi bit of the nybble is set to 1, the square will be plotted. The A register is pushed onto the stack again since the monitor PLOT routine destroys this register. The X and Y coordinates are taken from the variable table and placed in the Y and A registers. After the monitor PLOT, the nybble is pulled from the stack. An AND #\$7 reduces it to the three-bit move value. The move is accomplished by incrementing or decrementing X0 and

```
* LORES SHAPE TABLE SUBROUTINE
* ENTERED FROM BASIC WITH CALL 4353
X0 EQU $805
Y0 EQU $80C
SHAPE EQU $816
DATA EQU $1000
PLOT EQU $F800
ORG $1100

*
RTN RTS
START LDY SHAPE ;GET SHAPE NUMBER
      LDX #$0 ;INITIALIZE COUNTER TO 0
LOOP LDA DATA,X ;GET BYTE FROM SHAPE TABLE
      INX
      CMP #$0 ;END OF A SHAPE?
      BNE LOOP ;NO. KEEP LOOKING
      DEY ;YES. DESIRED SHAPE IS FOUND WHEN
      BNE LOOP ;Y EQUALS 0
DRAW LDA DATA,X ;GET BYTE TO BE PLOTTED
      CMP #$0 ;SHAPE DONE?
      BEQ RTN ;YES. GO BACK TO BASIC
      PHA ;NO. SAVE BYTE
      AND #$F ;GET LOW NYBBLE
      CMP #$8 ;PLOT?
      BCC NEXT ;NO. SKIP PLOTTING ROUTINE
      PHA ;YES. SAVE LOW NYBBLE
      LDA Y0 ;GET Y COORDINATE
      LDY X0 ;GET X COORDINATE
      JSR PLOT ;MONITOR PLOT ROUTINE
      PLA ;RESTORE LO NYBBLE
NEXT JSR COORD ;FIND NEW COORDINATES FOR X AND Y
      PLA ;GET ORIGINAL BYTE
      LSR ;SHIFT HI NYBBLE LO
      LSR
      LSR
      CMP #$8 ;SAME AS ABOVE
      BCC NEXT1
      PHA
      LDA Y0
      LDY X0
      JSR PLOT
      PLA
NEXT1 JSR COORD
      INX ;POINT TO NEXT BYTE
      JMP DRAW ;DO IT ALL AGAIN

*
```

\* THE FOLLOWING SECTION HANDLES THE MOVE SET BY THE NYBBLE

\*

—CONTINUED ON NEXT PAGE—



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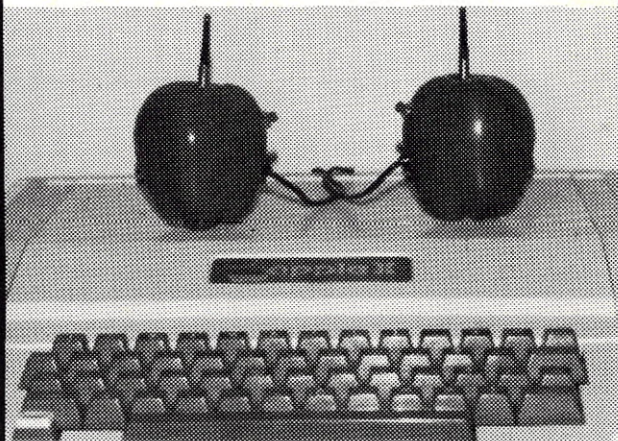
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# Lo-Res, continued...

```
COORD AND #$7      ;REDUCE TO 3 BIT VALUE
CMP #$0            ;FIND DIRECTION VALUE
BEQ UP
CMP #$1
BEQ DIAG1
CMP #$2
BEQ RIGHT
CMP #$3
BEQ DIAG2
CMP #$4
BEQ DOWN
CMP #$5
BEQ DIAG3
CMP #$6
BEQ LEFT
DIAG4 DEC XO        ;IF IT REACHES HERE, A=7
DEC YO
RTS
UP DEC YO
RTS
DIAG1 INC XO
DEC YO
RTS
RIGHT INC XO
RTS
DIAG2 INC XO
INC YO
RTS
DOWN INC YO
RTS
DIAG3 DEC XO
INC YO
RTS
LEFT DEC XO
RTS
```

Figure 3

Y0 as necessary. Next, the stack is pulled again, getting the original byte. Four LSR's put the hi nybble into the lo position. Then the PLOT (if the hi bit of the nybble is set) and move are done. X is incremented to point to the next byte, and the routine loops back to draw.

```
1100- 00 AC 16 08 02 00 BD 00
1108- 10 E8 C9 00 00 F8 88 00
1110- F5 BD 00 10 C9 00 F0 E8
1118- 40 29 0F C9 06 90 08 48
1120- AD AC 00 AC 05 08 20 00
1128- F8 68 20 48 11 68 4A 4A
1130- 4A 4A C9 08 90 0B 48 AD
1138- 0C 08 AC 05 08 20 00 F8
1140- 68 20 48 11 E8 4C 11 11
1148- 29 07 C9 00 F0 1F C9 01
1150- F0 1F C9 02 F0 22 C9 03
1158- F0 22 C9 04 F0 25 C9 05
1160- F0 25 C9 06 F0 28 CE 05
1168- 08 CE 0C 08 60 CE 0C 08
1170- 60 EE 05 08 CE 0C 08 60
1178- EE 05 08 60 EE 05 08 EE
1180- 0C 08 60 EE 0C 08 60 CE
1188- 05 08 EE 0C 08 60 CE 05
1190- 08 60
```

Figure 4

If LOMEM isn't set to \$800, the values of X0, Y0, and SHAPE in the symbol definitions will have to be adjusted. To relocate the program, just change the value of DATA and the value of JMP DRAW.

That's all there is to it, unless, as mentioned before, you want to add error checks (including one to make sure that SHAPE isn't given a value for which there is no table entry). Happy plotting. □

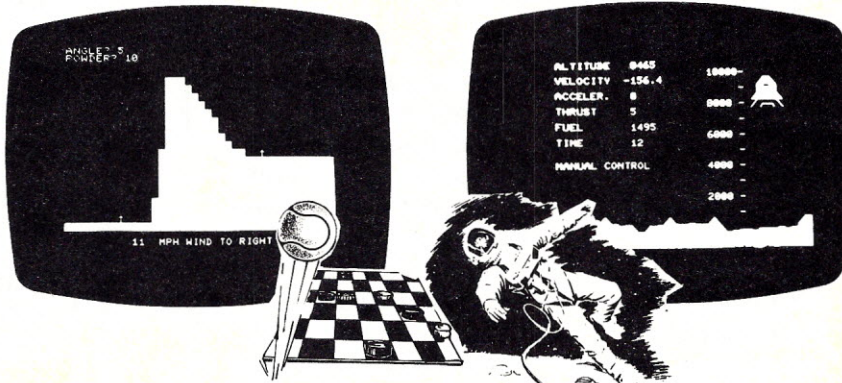
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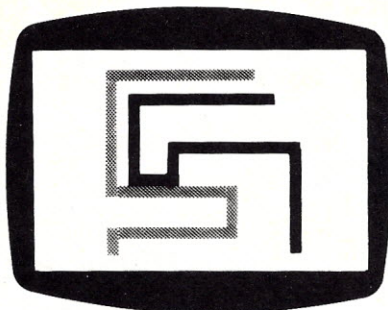
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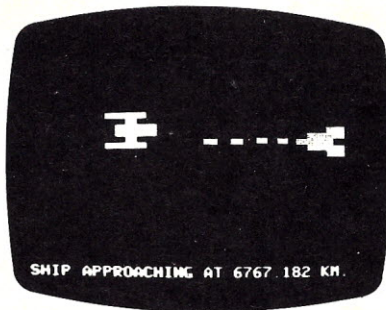


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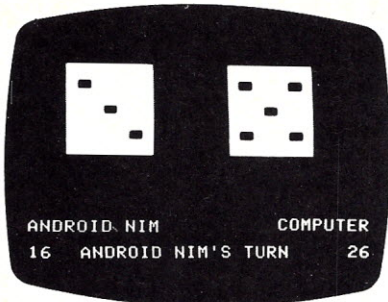
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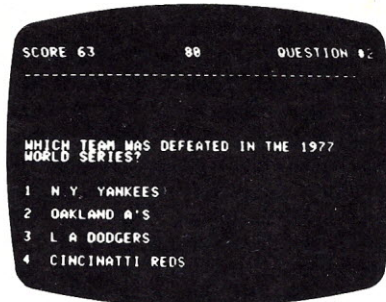
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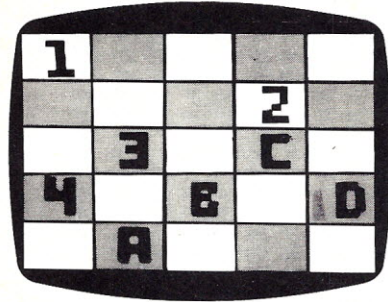
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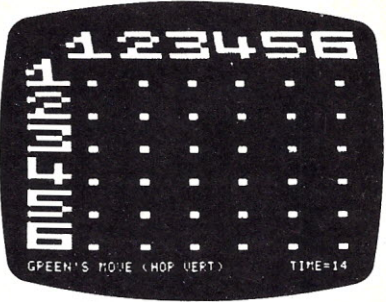
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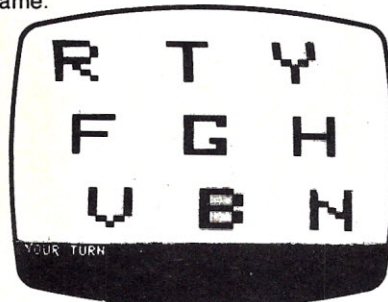
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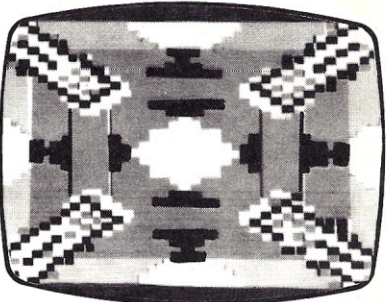
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# Hi-Res Text For The Apple

Paul Hitchcock

If this hasn't happened to you yet, beware—

You're sitting in front of your Apple II Plus, the graphics master and number-cruncher *extraordinaire*. Behind you a group of friends impatiently await the unveiling of your latest *Meisterwerk*: The graphical solution of Schroedinger's wave equation. The quantum universe begins to unfurl across the screen of your monitor; you, however, secretly listen for the inevitable murmurs of astonished approval. And when the last hi-res dot winks on the screen, you turn to the audience for the expected-but-highly-deserved applause. But instead of the roar of the crowd, you are confronted with a roomful of knitted brows. Time holds its breath while your confidence ebbs away. Suddenly a question rips apart the icy silence. No, not a question, but a searing, air-ionizing laser blast aimed to demolish the foundations of your programming expertise:

"Well, *surely* it labels the axes, doesn't it?"

A red haze diffuses across your eyes; through the blur you see your friends filing silently out of the room. Your barely audible mutterings (But Applesoft doesn't include a hi-res character set...) tip-toe across the room to fall on ears that will not hear. You have just been control-C'd into the Twilight Zone.

Maybe the preceding anecdote is a *little* exaggerated, but it does emphasize an important point: a graphics display should convey all of the information a user needs to understand what the display means. That generally means graphics *and* text. Without a generous sprinkling of alphanumeric, most graphs and charts and games are, in three words, boring, dull, and boring. But even more to the point, "naked" graphics are uninformative. A quick glance at the two histograms in Figure 1 will show you precisely what I

mean. Although the subject of "swimsuit sales" may not move you to the edge of your chair, at least you know what the graph is trying to say.

So how do you obtain a hi-res character set for your Apple? One inexpensive answer is found in the Apple's ability to draw user-defined, high-resolution "shapes." Listing 1 defines a table of such shapes which will give you the entire alphabet, ten digits, as well as several special characters (See Figure 2). By using the Applesoft DRAW, XDRAW, SCALE, and ROT commands in conjunction with this table, you will be able to print text quickly and easily on the hi-res screen.

I said the shape table was inexpensive, but it's not completely free: it will cost you 641 bytes of RAM. But I think you'll agree the price is reasonable when you see how

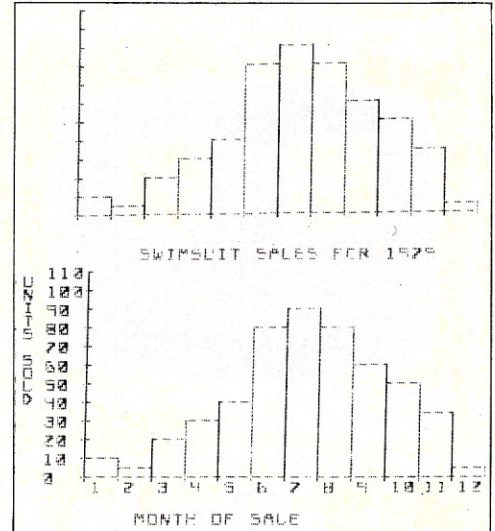


Figure 1

\*1000, 1280

```

1000- 38 00 78 00 7A 00 7C 00
1008- 7E 00 80 00 82 00 90 00
1010- 92 00 94 00 9C 00 04 00
1018- A6 00 AE 00 B0 00 B5 00
1020- B9 00 C1 00 00 00 08 00
1028- E4 00 EF 00 F9 00 05 01
1030- 11 01 1B 01 28 01 32 01
1038- 34 01 36 01 3F 01 48 01
1040- 51 01 53 01 55 01 62 01
1048- 6F 01 79 01 84 01 90 01
1050- 99 01 A4 01 B1 01 0A 01
1058- C2 01 CF 01 07 01 E3 01
1060- F1 01 FC 01 07 02 15 02
1068- 22 02 2D 02 37 02 43 02
1070- 4F 02 5C 02 6B 02 75 02
1078- 01 00 01 00 01 00 01 00
1080- 01 00 25 25 0E 18 2C 0E
1088- 09 3E 3E 66 49 3E 2C 00
1090- 01 00 01 00 24 2D 9F 32
1098- 36 2D 07 00 24 3F 8D 32
10A0- 36 3F 05 00 01 00 34 0E
10A8- 2D 36 24 2D 07 00 01 00
10B0- 9B 29 2D 07 00 12 37 25
10B8- 00 25 25 9E 33 37 37 04
10C0- 00 25 25 3F 3F 36 36 25
10C8- E5 93 2E 2D 25 24 04 00
10D0- 24 37 0A 36 3E 2D 07 00
10D8- 25 25 3F 3F 4E 32 3F 36
10E0- 2D 2D 07 00 2D 24 3F 3F
10E8- 96 32 2D 2D 24 04 00 2D
10F0- 24 0E C3 36 2D 2D 36 26
10F8- 00 3F 24 2D 2D 0E 2A 35
1100- 36 3F 3F 04 00 35 35 3E
1108- 3F 27 2C 0C 9F 24 2C 2D
1110- 00 25 25 3F 3F 56 31 37
1118- 37 3D 00 2D 24 3F 3F 36
1120- AD 2D 36 3F 3F 24 2D 00
1128- 2D 24 3F 3F 36 6D 31 36
1130- 04 00 01 00 01 00 2C FD
1138- 3A 3E 35 35 2D 07 00 2D

```

```

1140- 97 3D 3F 2F 08 38 2F 00
1148- 3C 6F 2A 2E 37 37 3F 05
1150- 00 01 00 01 00 2D 36 E6
1158- 0B 26 24 ED 23 25 2D 2E
1160- 06 00 2E 2E 3E 3F 27 24
1168- 24 2D 35 35 3F 3F 00 89
1170- 32 3F 3F 24 24 2C 2D 35
1178- 00 29 3E 3E 3E 27 24 24
1180- 2D 2E 06 00 AD 12 3F 3F
1188- 24 2C 0D 24 2D 2D 07 00
1190- 45 38 3F 37 2E 0D 36 26
1198- 00 2A 35 3E 3F 27 24 24
11A0- 2D 2D 06 00 2D 24 0E 18
11A8- 34 2E 0D 36 66 49 26 24
11B0- 00 24 2F 3D 36 36 3E 2D
11B8- 07 00 09 24 36 36 3E 3F
11C0- 27 00 2D 25 0E C3 36 36
11C8- 66 51 21 27 27 3F 00 52
11D0- 31 3F 3F 24 24 34 00 3C
11D8- 3C 36 36 66 49 26 24 24
11E0- 37 07 00 2E 36 25 24 24
11E8- 0E 33 3D 24 37 36 36 04
11F0- 00 09 24 3F 3F 36 36 2E
11F8- 2D 25 24 00 38 35 2D 2C
1200- 3C 3F 3F 36 36 26 00 09
1208- 24 3F 3F 36 36 2E 2D 0C
1210- AD 27 25 24 00 2E 2E E6
1218- 0B 26 24 24 2D 35 35 3F
1220- 3F 00 8F 12 2D 2D 24 3C
1228- 0F 24 2D 2D 00 24 3F 4E
1230- 09 3C 97 36 26 00 00 09
1238- 24 1E 08 33 36 36 2D 2D
1240- 24 04 00 09 24 1E 08 33
1248- 36 35 2E 25 2C 04 00 36
1250- 35 25 24 24 1E 08 33 36
1258- 36 25 05 00 25 25 3E 08
1260- 33 35 35 37 2C 2C 35
1268- 35 04 00 2D 24 1E 08 33
1270- 2E 35 36 04 00 25 25 3F
1278- 3F 95 31 37 37 2D 2D 07
1280- 00

```

Listing 1

Paul Hitchcock, 2309 Blake St., #308, Berkeley, CA 94704.

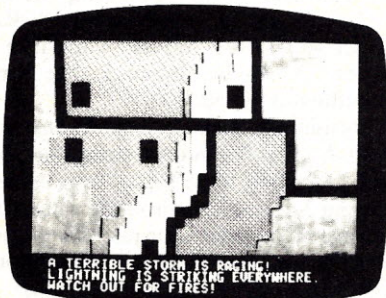


# Outdoor Games

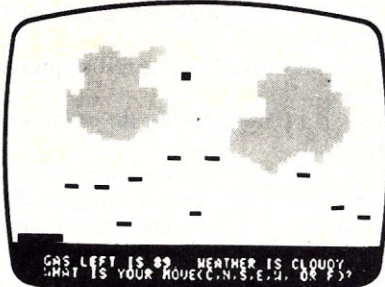
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4 Programs

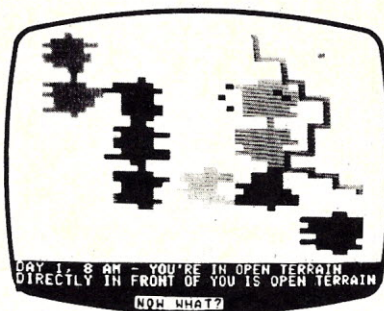
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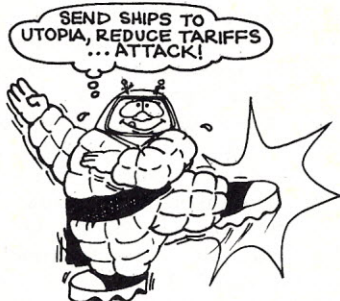
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## Hi-Res, continued...

much sparkle a bit of text will lend to your graphics displays.

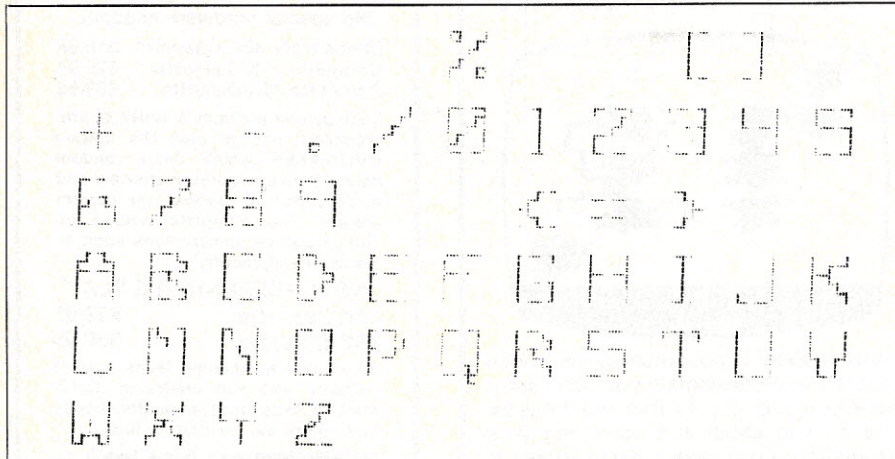


Figure 2

### Entering the Shape Table

To load the shape table, power up your Apple and enter the monitor by typing "CALL-151 (return)". Enter each line of the table as shown in Listing 1, except replace the "-" after each line number with a colon. After entering the table, you must store its length and its starting address in locations \$0-\$1 and \$E8-\$E9, respectively. You can accomplish these latter two operations with the following monitor commands:

```
Ø:8Ø Ø2 (return), and
E8:ØØ 1Ø (return).
```

When you have finished the above, go back to Applesoft with CTRL C (return). Type in and RUN the short test program given in Listing 2. If your television or monitor display looks substantially like Figure 2, you're ready to save the table on tape. If it doesn't, go back and fix things up. Unless you're the type who remembers phone numbers and zip codes in hex, it's all too easy to make a mistake.

#### Listing 2

```
1Ø HGR : HCOLOR= 3
2Ø SCALE= 3
3Ø ROT= Ø
4Ø N= 1
5Ø FOR J = 1Ø TO 135 STEP 25
6Ø FOR I = 7 TO 257 STEP 25
7Ø IF N = 6Ø THEN 12Ø
8Ø DRAW N AT I,J
9Ø N = N + 1
1ØØ NEXT I
11Ø NEXT J
12Ø END
```

### Saving the Table on Tape

To save the table on tape, re-enter the monitor (CALL-151) and type  
Ø.1W 1ØØØ.128ØW

Put a clean tape in your recorder, start recording, and press (return). After two

beeps the cursor will reappear, indicating the table has been saved.

For your own mental well-being, it would be a good idea to make three or four

copies of the shape table. I'm sure you know what I mean: you make several copies of something on tape, and each copy loads perfectly. Just make a single copy, though, and it will invariably fail to load. While Mr. Murphy might chuckle with smug satisfaction, this kind of thing turns me into a hapless psychotic.

In the future, you enter the shape table into your computer just as you would enter a cassette program, with one exception: instead of typing "LOAD", you type "SHLOAD". You can load the shape table even if you already have a program in memory, so SHLOAD can actually be activated as a program statement. However, those of you with Apples having only 16K RAM must take a special precaution before loading your tables. When you enter the table via the SHLOAD command, the Apple places the table immediately below the memory address specified by the current HIMEM setting. But when the Apple is first turned on, HIMEM is set to the highest available memory address—16384, if you have a 16K machine. When you enter the hi-res graphics mode with the command HGR, all of the addresses from 8192 to 16384 (the hi-res picture bufer) are cleared, i.e., set to zero. So you must set HIMEM to 8192 (or lower) before you load your table, to avoid automatically erasing it.

### Text Writing in Hi-Res

The shapes in the table are numbered, and to draw a particular shape on the screen, you refer to its number in a DRAW statement. For example, the letter "A" has the number 34, and you draw this letter at the screen coordinates X, Y with the command "DRAW 34 AT X, Y". Now the fifty-nine shapes in the table have been arranged so that the table number of a given shape is related to the ASCII number of the character the shape represents through the following formula:

$N(\text{character}) = \text{ASC}(\text{"character"}) - 31$ , where N is the table number of the character enclosed in parentheses. With this function, you can forget about table numbers and can draw a character just by referring to the character itself. Again using the letter "A" as an example, the command "DRAW ASC("A")-31 AT 3Ø, 5Ø" will cause the letter "A" to be drawn at the screen coordinates 3Ø, 5Ø.

By using the above formula in conjunction with Applesoft's built-in string functions, you can easily write text strings in hi-res; Listing 3 defines a subroutine I have used in several programs for just this purpose. Before you call the subroutine though, you have to initialize four variables:

XN,YN—the coordinates of the first letter of the string

NS—the string to be printed

ZN—the horizontal/vertical printing flag. When the flag is down (ZN=Ø), printing proceeds horizontally;

when it is up (ZN=1), the string will be printed in

the vertical (downward) direction.

Listing 4 provides a short example of how to use the text printing subroutine and Figure 3 shows the screen output of the program in Listing 4.

***I said the shape table  
was inexpensive,  
but it's not  
completely free:  
it will cost you  
641 bytes of RAM.***

### Advice and Limitations

You've probably noticed that I failed to include a number of special characters in the shape table (!/ # \$ % & ' / : ; ? / @). Your programs won't bomb if you include any of these characters in a text string—the illegal character will just be interpreted as a space character. The decision to omit these characters was completely arbitrary; if you want to add some (or all) of them to your table, you'll find the instructions for

```
3ØØ HGR : HCOLOR= 3
31Ø POKE - 163Ø2,Ø: REM FULL SCREEN
32Ø ZN = Ø: REM HORIZONTAL PRINTING
33Ø NS = "APPLE SINE"
34Ø XN = 1Ø5:YN = 2Ø
35Ø GOSUB 2ØØØØ
36Ø FOR XN = 6 TO 273 STEP 7
37Ø YN = 79 - 4Ø * SIN (6.28 * (XN - 6) / 139)
38Ø ZN = 1: REM VERTICAL PRINTING
39Ø GOSUB 2ØØØØ
4ØØ NEXT XN
41Ø HPLØT 2,Ø TO 279,Ø TO 279,191 TO 2,191 TO 2,Ø
42Ø END
```

Listing 4



doing so in the *Applesoft II Reference Manual*. Should you need only a limited number of the shape table characters for a particular application, the manual will also show you how to "cannibalize" the table to get the characters you want.

The shape table character set does suffer from one minor functional limitation: you may only print white (HCOLOR= 3) text on a black (HCOLOR= 0) background, or vice versa. Because of the way the Apple displays colored lines in hi-res, an attempt to write text using any other color combination will result in missing line segments in all of the printed characters. In short, whatever you write will be unintelligible, although it might look pretty stylish.

As far as letter and line spacing is concerned, I've found the following rule-of-thumb to be useful: the distance between

```
20000 REM *HI-RES PRINTING SUBROUTINE*
20005 SCALE= 1: ROT= 0
20010 FOR CN = 1 TO LEN (N$)
20020 Q$ = MID$(N$,CN)
20030 IF ZN THEN 20060
20040 BRAH ASC (Q$) - 31 AT XN + 7 * (
CN - 1),YN
20050 GOTO 20070
20060 BRAH ASC (Q$) - 31 AT XN,YN + 7
* (CN - 1)
20070 NEXT CN
20080 ZN = 0
20090 RETURN
```

Listing 3

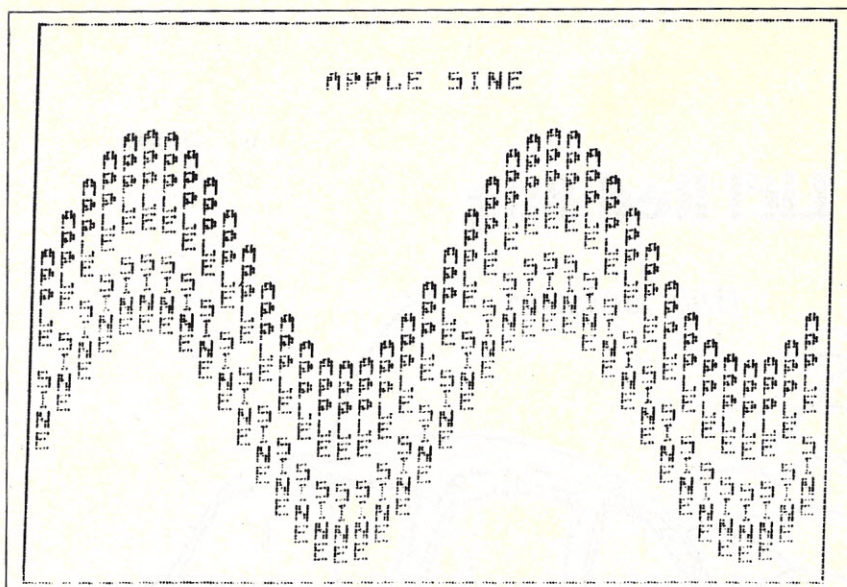


Figure 3

two characters or two lines of characters should be seven times the value of the SCALE; that is, if you print the first character of a text string at the coordinates X,Y, and you have previously specified that SCALE= S, the next character of the string will have the coordinates X+7\*S,Y. By the way, if you follow this rule with SCALE= 1, you have room for twenty-three lines of hi-res text with forty characters per line.

The subroutine in Listing 3 represents

only an elementary example of what you will be able to do with the character set. By experimenting with different letter and line spacings, you should be able to output hi-res text in nearly any conceivable format. Your graphs and your games will begin to communicate much more effectively—and isn't that what graphics is all about?

I hope you find this simple character set to be as useful as I've found it to be. So—as far as hi-res text is concerned—write soon, and write often! □



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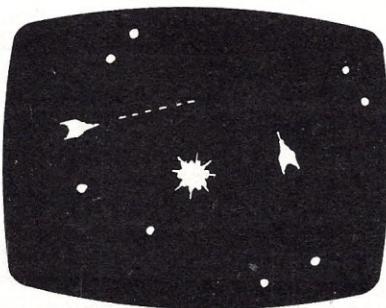
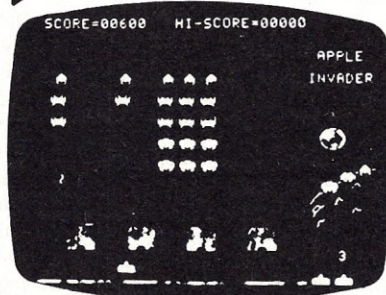
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CIRCLE 166 ON READER SERVICE CARD

JANUARY 1981



## Super Invasion and Space War

Disk CS-4508 \$29.95  
Requires 48K Apple II or Apple II Plus



### Super Invasion

This original invasion game features superb high resolution graphics, nail biting tension and hilarious antics by the moon creatures. Fifty-five aliens whiz across the screen, quickening their descent, challenging you to come out from behind your blockades and pick them off with your lasers. A self-running "attract mode" makes it easy to learn and demonstrate the game. Game paddles are required.

### Space War

Take command in Space War. Select from five game modes, including reverse gravity, and the battle begins. Challenge your opponent with missile fire, force him to collide with the sun or to explode upon re-entry from hyperspace. Be wary... He may circle out of sight and re-appear on the opposite side of the galaxy. (This is the classic MIT game redesigned especially for the Apple.)

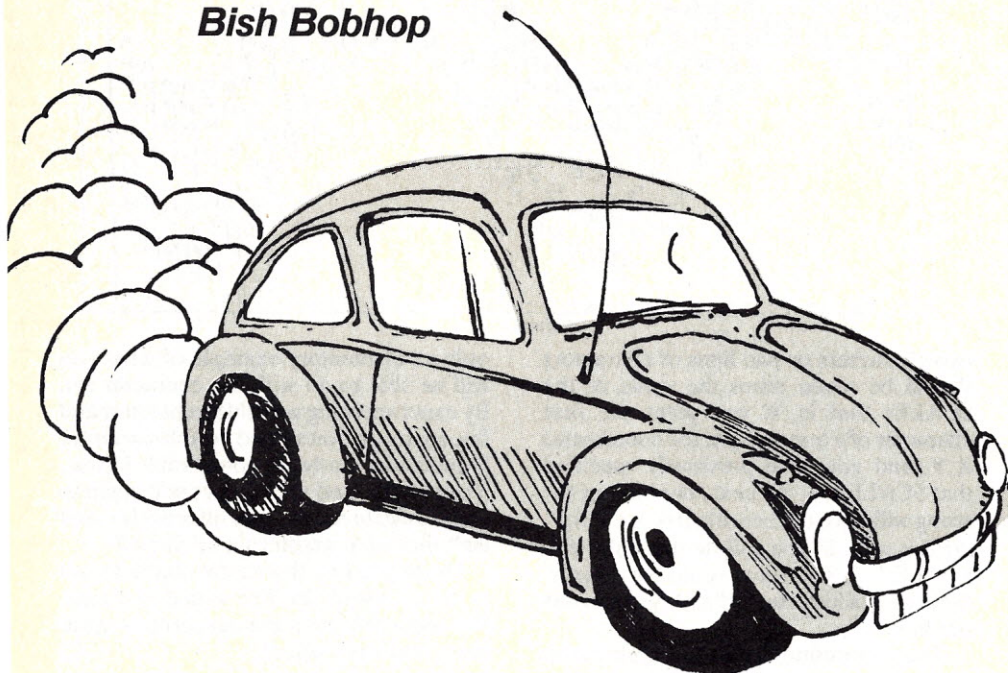
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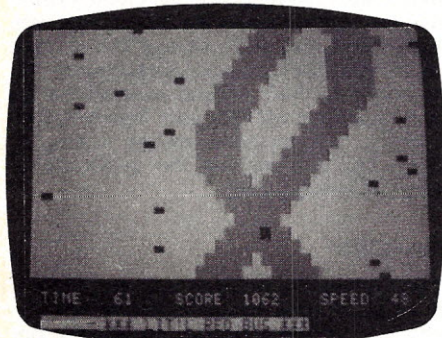
# Lit'l Red Bug

*Bish Bobhop*



*Lit'l Red Bug* is a game of skill in which you must drive your Volkswagen along a road without going off the pavement. The faster you go, the more points you get...unless you leave the road. Off the road, you begin to lose points. The faster you go, the more points you lose!

If you don't have a color display, you might want to change the last part of line 10 to read: CAR=15 instead of: CAR=1.



This will change the color of the "bug" to white so that it will show up better on a black and white set.

The program is written in Apple-II integer Basic with just a touch of machine language for class.

Bish Bobhop, Apple Computer, 10260 Brandley Dr., Cupertino, CA 95014.

Note: Besides the Basic portion of *Lit'l Red bug*, there are three portions of machine code which have to be entered; two programs and one data table. The easiest way to enter this code is through direct hex entry in the monitor. For the table, just type 1000: followed by the data. If RETURN is used, begin the next line with another colon. Once this table is entered, the two short programs can be entered in two ways. Either the assembler can be used, or more simply, the hex code in the second column can be entered. For each program, enter the starting address, followed by a colon, then start typing the groups of numbers in the second column. Again, when you hit return, type another colon. After entering all the code, check the results by typing the first address followed by an L. This should cause the screen to display exactly what is shown in the listing. To save the data on cassette, use 1000.1163W. To save it on disk, use BSAVE TITLE, A\$1000, L\$164.

Second note: The author, Bish Bobhop, is the lesser-known brother of a certain mythical figure who works deep in the halls of the Elppa Computer Company.

\*1000.103F

1000-	00 80 00 80 00 80 00 80		
1008-	28 A8 28 A8 28 A8 28 A8		
1010-	50 00 50 00 50 00 50 00		
1018-	00 00 00 00 00 00 00 00		
1020-	04 04 05 05 06 06 07 07		
1028-	04 04 05 05 06 06 07 07		
1030-	04 04 05 05 06 06 07 07		
1038-	00 0A 0A 0A 0A 0A 0B 0A		
104E-	A2 13	LOX	#\$13
1080-	80 00 10	LDA	\$1000,X
1083-	85 02	STA	\$02
1085-	80 20 10	LDA	\$1020,X
1088-	85 03	STA	\$03
108A-	CA	DEX	
108B-	80 00 10	LDA	\$1000,X
108E-	85 00	STA	\$00
10C0-	80 20 10	LDA	\$1020,X
10C3-	85 01	STA	\$01
10C5-	A0 27	LDY	#\$27
10C7-	B1 00	LDA	(\$00),Y
10C9-	91 02	STA	(\$02),Y
10CB-	88	DEY	
10CC-	10 F9	BPL	\$10C7
10CE-	80 FF FF	STA	FFFF
10D1-	E0 00	CPX	#\$00
10D3-	00 0B	BNE	\$10B0
10D5-	80	RTS	
10D6-	00	BRK	
10EE-	A5 00	LDA	\$00
10F0-	85 02	STA	\$02
10F2-	88	PLA	
10F3-	48	PHA	
10F4-	C6 02	DEC	\$02
10F6-	00 FA	BNE	\$10F2
10F8-	80 30 C0	STA	\$C030
10FB-	C6 01	DEC	\$01
10FD-	00 EF	BNE	\$10EE
10FF-	60	RTS	
1100-	A9 90	LDA	#\$90
1102-	85 00	STA	\$00
1104-	A9 40	LDA	#\$40
1106-	85 01	STA	\$01
1108-	20 EE 10	JSR	\$10EE
110B-	A9 74	LDA	#\$74
110D-	85 00	STA	\$00
110F-	A9 57	LDA	#\$57
1111-	85 01	STA	\$01
1113-	20 EE 10	JSR	\$10EE
1116-	A9 50	LDA	#\$50
1118-	85 00	STA	\$00
111A-	A9 61	LDA	#\$61
111C-	85 01	STA	\$01
111E-	20 EE 10	JSR	\$10EE
1121-	A9 40	LDA	#\$40
1123-	85 00	STA	\$00
1125-	A9 00	LDA	#\$00
1127-	85 01	STA	\$01
1129-	20 EE 10	JSR	\$10EE
112C-	A9 50	LDA	#\$50
112E-	85 00	STA	\$00
1130-	A9 61	LDA	#\$61
1132-	85 01	STA	\$01
1134-	20 EE 10	JSR	\$10EE
1137-	A9 40	LDA	#\$40
1139-	85 00	STA	\$00
113B-	A9 00	LDA	#\$00
113D-	85 01	STA	\$01
113F-	20 EE 10	JSR	\$10EE
1142-	A9 40	LDA	#\$40
1144-	85 00	STA	\$00
1146-	A5 00	LDA	\$00
1148-	85 01	STA	\$01
114A-	20 EE 10	JSR	\$10EE
114D-	A9 40	LDA	#\$40
114F-	85 00	STA	\$00
1151-	A9 00	LDA	#\$00
1153-	85 01	STA	\$01
1155-	20 EE 10	JSR	\$10EE
1158-	A9 40	LDA	#\$40
115A-	85 00	STA	\$00
115C-	A5 00	LDA	\$00
115E-	85 01	STA	\$01
1160-	4C EE 10	JMP	\$10EE



```

5 X=Y=L=OL=R=OR=SPEED=POS=TOT=TIME=Z=BACK
10 ROAD=5:FIELD=12:BUSH=4:CAR=1
20 DOWN=4096+174
40 GOSUB 2000
60 TOT=0:TIME=425:Y=TIME/12+3
70 POS=1500:X=POS/75:BACK=ROAD
80 L=16:OL=0:R=20:OR=0
100 COLOR=BACK: ULIN Y-1,Y AT X
150 CALL DOWN
160 Z= PEEK (-16336):Z= PEEK (-16336)
200 POS=POS+ PDL (0)-128: IF POS<0 THEN POS=0: IF POS>2999
    THEN POS=2999

220 TIME=TIME-1:Y=TIME/12+3
230 X=POS/75:BACK= SCRN(X,Y)
250 COLOR=CAR: ULIN Y-1,Y AT X
300 COLOR=FIELD: HLIN 0,39 AT 1: HLIN 0,39 AT 0
310 COLOR=BUSH: PLOT RND (40),1
320 COLOR=ROAD: HLIN L,L+4 AT 1: HLIN R,R+4 AT 1: HLIN L,L+4
    AT 0: HLIN R,R+4 AT 0
350 Z= PEEK (-16336):Z= PEEK (-16336)
400 IF NOT RND (5) THEN OL= RND (3)-1
410 IF NOT RND (5) THEN OR= RND (3)-1
420 IF L=1 THEN OL=1: IF L=33 THEN OL=-1
430 IF R=1 THEN OR=1: IF R=33 THEN OR=-1
450 L=L+OL:R=R+OR
480 SPEED=(255- POL (1))/5
490 FOR K=0 TO SPEED: NEXT K
500 TOT=TOT+60-SPEED
520 IF BACK=FIELD THEN 1000
540 Z= PEEK (-16336):Z= PEEK (-16336)
550 UTAB 22: TAB 9: PRINT TIME/6: " ": TAB 22: PRINT TOT:
    " ": TAB 37: PRINT 90-SPEED
600 IF TIME>0 THEN 100
700 TEXT : CALL -936: UTAB 5
710 TAB 12: PRINT "---- GAME OVER ----"
720 UTAB 12: PRINT " YOUR SCORE OF ";TOT;" IS ";
730 IF TOT>10000 THEN 750
740 PRINT "TERRIBLE!": PRINT : IF TOT<5000 THEN PRINT "(YOU
    SHOULD BE ASHAMED OF YOURSELF!)"
750 IF TOT>10000 AND TOT<15000 THEN PRINT "PRETTY BAD!"
760 IF TOT>15000 AND TOT<19000 THEN PRINT "ABOUT AVERAGE."
770 IF TOT>19000 AND TOT<22000 THEN PRINT "VERY GOOD!"
780 IF TOT>22000 THEN PRINT "EXCELLENT!"
790 IF TOT>24000 THEN CALL 4352
800 FOR K=1 TO 1000: NEXT K
810 UTAB 20: PRINT "PUSH EITHER PADDLE BUTTON TO PLAY AGAIN"
820 IF PEEK (-16286)>128 AND PEEK (-16287)>128 THEN 820
850 GOSUB 2050
900 GOTO 60
1000 FOR K=1 TO 20:Z= PEEK (-16336): NEXT K
1010 TOT=TOT-5*(50-SPEED):TIME=TIME-1
1020 IF TOT<0 THEN TOT=0
1050 GOTO 550
2000 TEXT : CALL -936
2010 UTAB 10: TAB 10: PRINT "*** LIT'L RED BUG ***"
2020 PRINT : TAB 19: PRINT "BY"
2030 PRINT : TAB 15: PRINT "BISH BOBHOP"
2040 FOR K=1 TO 1500: NEXT K
2045 GOSUB 3000
2050 GR : POKE -16298,0
2060 UTAB 22: PRINT " TIME:": TAB 15: PRINT "SCORE:":
    TAB 30: PRINT "SPEED:
    "
2070 POKE 50,63: UTAB 24: TAB 2: PRINT " *** LIT'L RED BUG ***
    " : POKE 50,255
2100 FOR K=0 TO 39
2110 COLOR=FIELD: HLIN 0,39 AT K
2120 COLOR=BUSH: IF K MOD 2 THEN PLOT RND (40),K
2130 COLOR=ROAD: HLIN 16-K/8,24+K/8 AT K
2140 NEXT K
2200 RETURN
3000 CALL -936: TAB 10: PRINT "*** LIT'L RED BUG ***"
3010 PRINT : PRINT "THE OBJECT OF THIS GAME IS TO
    DRIVE YOUR"
3020 PRINT "LITTLE RED VOLKSHAGEN DOWN THE ROAD AS"
3030 PRINT : PRINT "FAST AS YOU CAN WITHOUT GOING OFF THE"
3040 PRINT : PRINT "PAVEMENT. GAME PADDLE 0 IS YOUR STEER-"
3050 PRINT : PRINT "ING WHEEL, AND PADDLE 1 IS YOUR ACCELER-"
3060 PRINT "ATOR. HAVE A NICE RIDE!"
3090 FOR K=1 TO 1000: NEXT K
3100 UTAB 22: PRINT "PUSH EITHER GAME PADDLE BUTTON TO BEGIN"
3110 IF PEEK (-16286)>128 AND PEEK (-16287)>128 THEN 3110
3120 IF PEEK (-16286)>127 OR PEEK (-16287)>127 THEN 3120
3200 CALL -936: RETURN

```



# APPLE II TRS-80

## QUALITY

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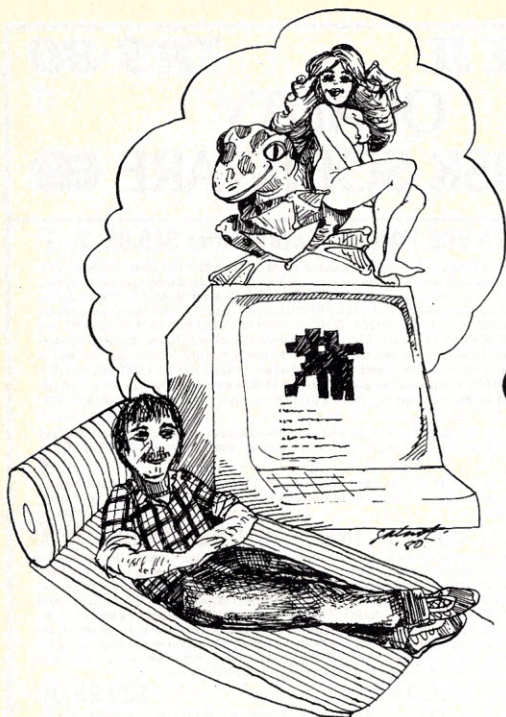
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# The Digital Couch

David Tunbo

The Digital Couch program turns your computer into a psychiatrist. It draws a picture not unlike an inkblot and gives three choices as to what the picture looks like. The program keeps score and rates the player when the "tests" are over.

The program draws a picture by POKEing a graphics block symbol at the center of the screen. One of four directions is selected at random and another block is added after checking that the new block will not cross a previous one, or go off of the screen. When it becomes trapped and cannot place a new block, the picture is finished.

## The pictures match the titles more often than you might think.

Lines 400-412 are the choices for the picture titles, and are selected at random. The list can be expanded to your heart's (and patience's) desire. If the player picks the correct answer (also chosen at random) then one is added to their score, and a new picture is drawn. If the player's choice is wrong, then a randomly selected sub-routine (lines 500-900) asks some nosy questions and makes a few disparaging remarks. These can also be expanded.

When the "tests" are over the player is "graded" on how well he or she has performed, and a diagnosis is reached.

I use the program at parties, and the results are very entertaining. The drawing progression is fascinating to watch, and the drawings sometimes become quite complex. The pictures match the titles more often than you might think.

The Digital Couch was written on an Ohio Scientific Challenger II. ☐

David Tunbo, 747 N. Neblett, Stephenville, TX 76401.

RUN

\*\*\*\*\* THE DIGITAL COUCH \*\*\*\*\*

Do you want instructions (1)=yes (2)=no? 1

THE DOCTOR WILL SEE YOU NOW.

HELLO. I'M GOING TO PRESENT A SERIES OF PICTURES FOR YOU TO LOOK AT. WHEN I ASK YOU, INDICATE WHICH OF THE THREE CHOICES IT LOOKS LIKE TO YOU.

BASED ON YOUR ANSWERS, I WILL EVALUATE YOUR MIND. ANSWER THE QUESTIONS AS HONESTLY AS POSSIBLE OR I WILL CALL YOUR MOMMY ON YOU.

How many tests do you want? 1  
Hit 'return' for test # 1 ?

IS THIS A:  
( 1 ) RODNEY  
( 2 ) CREEPY CANAL  
( 3 ) PEANUT BUTTER JET PLANE  
? 3  
NO, IT'S A RODNEY  
YOUR ANSWER IS NOT CORRECT.....BUT IT IS MEANINGFUL.

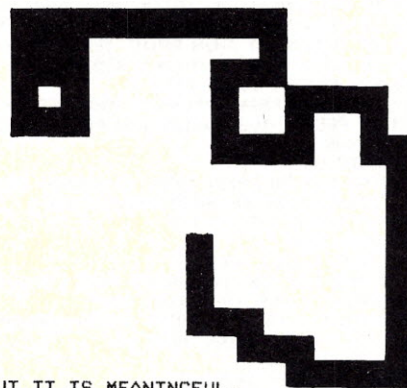
LET'S SEE NOW.  
YOUR SCORE IS 0 %

I WOULD SAY...  
YOU REALLY ARE A MESS!!

OK  
LIST

OK  
LIST

```
5 DIM H$(12),F$(3),L$(6):S=0
6 Z=0:W=0
8 GOSUB 400
9 FOR T=1 TO 30:PRINT:NEXT T
10 PRINTTAB(15)"***** THE DIGITAL COUCH *****"
20 PRINT:PRINT:INPUT"Do you want instructions (1)=yes (2)=no";B
30 IF B=1 THEN 1000
40 IF B=2 THEN 50
45 GOTO20
50 PRINT:PRINT:INPUT"How many tests do you want";C
52 IF C<=0 THEN 50
55 IF C>5 THEN PRINT"MAKE IT EASY ON YOURSELF--NOT SO MANY.":GOTO 50
60 FOR D=1 TO C
65 PRINT:Hit 'return' for test #";D;:INPUT L
70 A=54302
80 FOR I=1 TO 30:PRINT:NEXT I
90 N=0
```





```

100 POKE A,161
110 N=N+1
120 X=INT(4*RND(X)+1)
130 IF N>10 THEN 240
140 ON X GOTO 150,160,170,180
150 I=64:GOTO 190
160 I=1:GOTO 190
170 I=-64:GOTO 190
180 I=-1:GOTO 190
190 A=A+I
200 IF PEEK(A)=161 THEN A=A-I:GOTO 110
210 IF A>55030 OR A<53696 THEN A=A-I:GOTO 110
230 GOTO 90
240 PRINT"IS THIS A:"
245 P=INT(3*RND(1)+1)
250 FOR Q=1 TO 3
255 R=INT(12*RND(1)+1)
257 IF Q=1 THEN M=R
259 IF Q=2 THEN E=R
262 IF M=E THEN 255
265 IF Q=3 THEN F=R:IF F=E OR F=M THEN 255
270 PRINT("Q;R;E;F;H$(R)";
275 F$(Q)=H$(R)
280 NEXT Q
285 INPUT T
287 IF T <1 OR T>3 THEN 285
290 IF T=P THEN PRINT"VERY GOOD! THAT'S RIGHT!";S=S+1:GOTO 299
295 PRINT"NO, IT'S A ";F$(P):GOSUB 500
299 NEXT D
300 SC=INT((S/C)*100):PRINT:PRINT:PRINT"LET'S SEE NOW."
302 PRINT"YOUR SCORE IS ";SC;"%";PRINT:PRINT"I WOULD
    SAY...";FOR T=1 TO 500:NEX
T T
305 IF SC<=20 THEN PRINT"YOU REALLY ARE A MESS!!":GOTO 390
310 IF SC>20 AND SC<=40 THEN PRINT L$(1):GOTO 390
320 IF SC>40 AND SC<=60 THEN PRINT L$(2):GOTO 390
330 IF SC>60 AND SC<=80 THEN PRINT L$(3):GOTO 390
340 IF SC>80 AND SC<=99 THEN PRINT L$(4):GOTO 390
350 IF SC>99 THEN PRINT L$(5);L$(6):GOTO 390
390 END
400 H$(1)="RODNEY"
401 H$(2)="SICK STAIR CASE"
402 H$(3)="CAT FLYING UPSIDE DOWN"
403 H$(4)="BIRD IN A HALTER TOP"
404 H$(5)="PEANUT BUTTER JET PLANE"
405 H$(6)="DRUNK WITH A FLAT TIRE"
406 H$(7)="WILTED FIRE PLUG"
407 H$(8)="PLATE OF REFRIED BEANS"
408 H$(9)="FROG WITH NUDE"
409 H$(10)="CREEPY CANAL"
410 H$(11)="NAZI ANT HILL"
411 H$(12)="MARTAIN PAGODA"
412 L$(1)="THAT YOUR BRAIN IS A HALF BUBBLE OFF CENTER!"
413 L$(2)="THAT YOU ARE PERFECTLY WELL ADJUSTED AND NORMAL!"
414 L$(3)="THAT YOU SHOULD BE KEPT AWAY FROM SHARP OBJECTS!"
415 L$(4)="THAT TO GET THIS MANY RIGHT YOU ARE GIFTED WITH ESP!"
416 L$(5)="THAT IF YOU GOT ALL OF THEM RIGHT THEN YOU HAVE A VERY "
417 L$(6)="TWISTED MIND AND SHOULD BE IN A MANAGEMENT POSITION!"
418 RETURN
500 V=INT(4*RND(1)+1)
505 IF V=W OR V=Z THEN 500
510 ON V GOTO 520,600,700,800
520 PRINT"HMMMMM":FOR T=1 TO 300:NEXT T
530 INPUT"YOU NEVER HAD A PUPPY WHEN YOU WERE A CHILD, DID YOU?";W$
540 IF W$="Y" OR W$="YES" THEN PRINT"UH OH!!"
550 IF W$="N" OR W$="NO" THEN PRINT"I THOUGHT SO. THINGS LIKE THAT SHOW."
560 W=1
570 GOTO 900
600 PRINT"AH, HA!! THAT IS A VERY REVEALING CHOICE!!!"
610 INPUT"IS YOUR FAVORITE DISH SPINICH AND LIVER WITH BLUE BERRIES?";W$
620 IF W$="Y" OR W$="YES" THEN PRINT"YOU HAVE A PROBLEM THAT I CANNOT HELP."
630 IF W$="N" OR W$="NO" THEN PRINT"WHEW, THAT'S VERY GOOD FOR YOU!"
640 Z=2
650 GOTO 900
700 PRINT"YOUR ANSWER IS NOT CORRECT.....BUT IT IS MEANINGFULL."
710 GOTO 900
800 PRINT"YOU'RE CLOSE, BUT NOT RIGHT. YOU SHOULD HAVE COME TO ME SOONER."
810 GOTO 900
900 RETURN
1000 FOR T=1 TO 30:PRINT:NEXT T
1010 PRINT"THE DOCTOR WILL SEE YOU NOW.";FOR T=1 TO 300:NEXT T
1020 FOR T=1 TO 30:PRINT:NEXT T
1030 PRINT"HELLO. I'M GOING TO PRESENT A SERIES OF PICTURES"
1040 PRINT"FOR YOU TO LOOK AT. WHEN I ASK YOU, INDICATE WHICH OF"
1050 PRINT"THE THREE CHOICES IT LOOKS LIKE TO YOU."
1060 PRINT"BASED ON YOUR ANSWERS, I WILL EVALUATE YOUR MIND."
1070 PRINT"ANSWER THE QUESTIONS AS HONESTLY AS POSSIBLE OR I WILL"
1080 PRINT"CALL YOUR MOMMY ON YOU."
1090 GOTO 50

```

OK

JANUARY 1981

133

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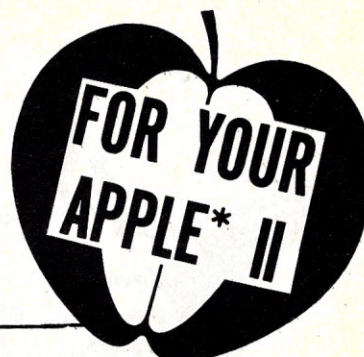


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- PAY 4 - reports all outstanding Accounts Payables for a single customer or for all customers, and computes Cash Requirements.
- PAY 5 - reports all outstanding Accounts Payables for a single date or for a range of dates and computes the Cash Requirements.
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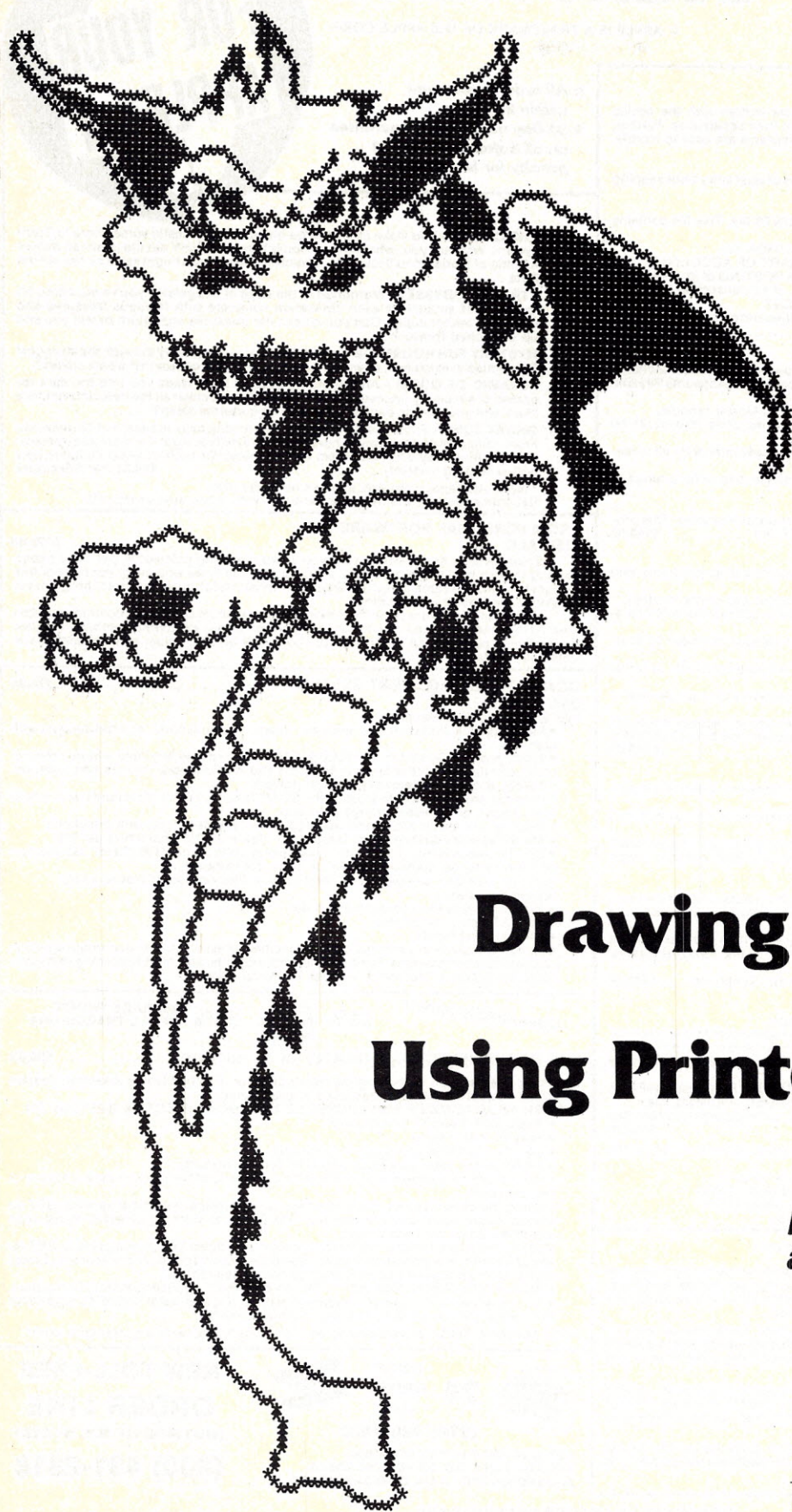
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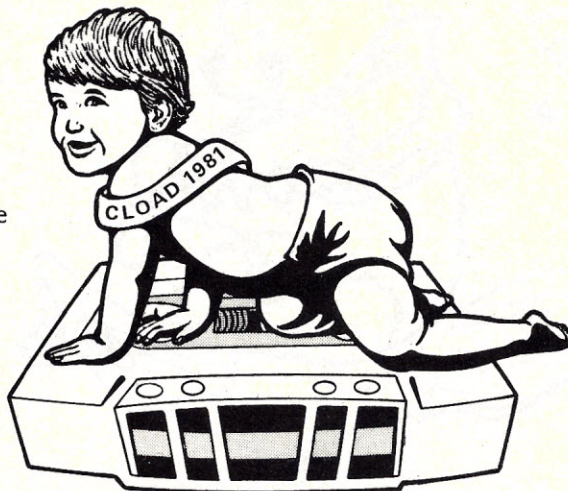
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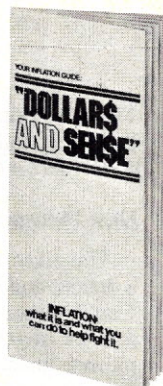
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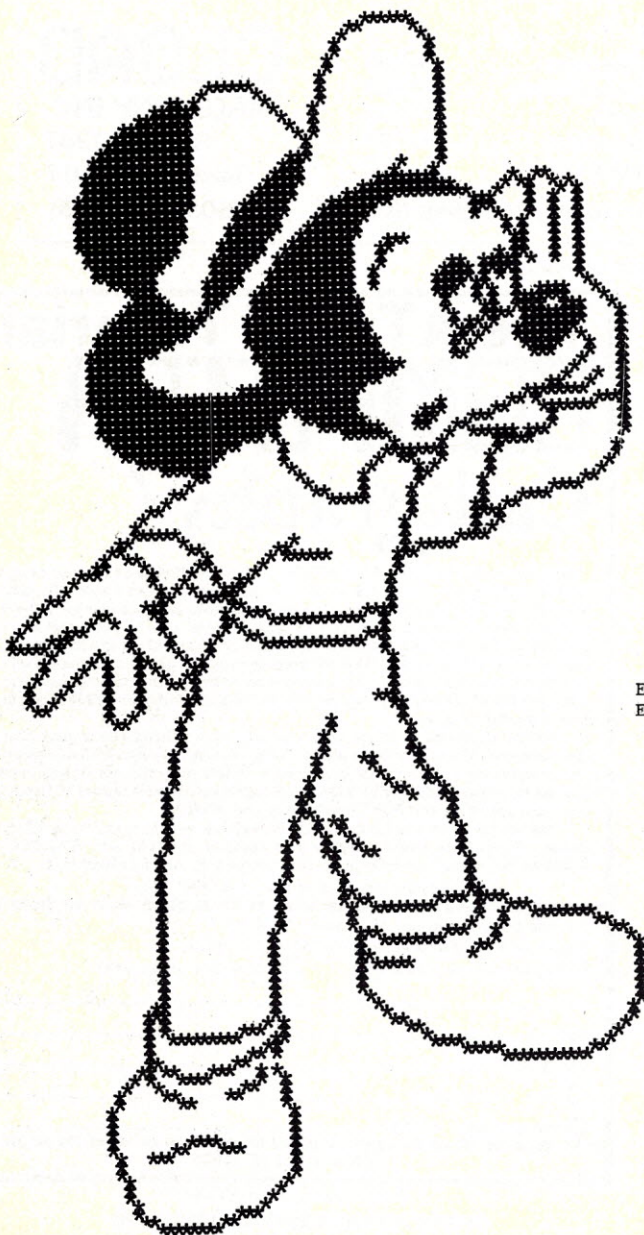
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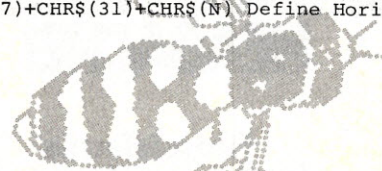
Printer graphics bring to mind wall murals and posters. Most printer pictures require standing back several yards to be fully appreciated. This type of picture usually has a 2:1 distortion of height versus width (i.e. one letter down is about two letters across in distance).

Printer plotting offers an improvement over the standard techniques because pictures can be printed with any horizontal to vertical ratio. One data file can produce many different interpretations of the same picture. The scale can be  $\frac{1}{2}$  of the original size or larger. It is also possible to make tall and thin or short and fat pictures.

Since this method provides greater control of where each character is printed, other factors should not louse this up. The main problem is to keep the paper from shifting during printing. The best way to prevent shifting is to only move the paper in one direction and to use a tractor feed. The paper tends to 'slop' when it is moved both up and down. Without the tractor feed the paper tends to 'walk' even unidirectionally. Using friction-feed bidirectionally was disastrous for us.

This technique requires a printer with a 'graphics' mode. It must be possible to adjust the horizontal and vertical increments between characters using software. For example, our Diablo 1620 can be set to any increment of  $\frac{1}{120}$  inch across or  $\frac{1}{48}$  inch down. The following control functions are used to set the horizontal and vertical motion for our machine.

```
ESC RS m CHR$(27)+CHR$(30)+CHR$(M) Define Vertical Motion
ESC US n CHR$(27)+CHR$(31)+CHR$(N) Define Horizontal Motion
```



The resulting distance between characters is  $(m-1) * \frac{1}{120}$  inch vertically and  $(n-1) * \frac{1}{48}$  inch horizontally. Refer to your own printer manual for its control functions.

#### How Pictures Are Made

The pictures are made by first choosing an original, making a digitization of it and then entering the data into the computer. The first step is to find or make a good line drawing. Next, put a piece of graph paper over it and fill in the squares over the picture lines. When the picture on the graph paper is a good representation of the original then it is ready to enter using a text editor.



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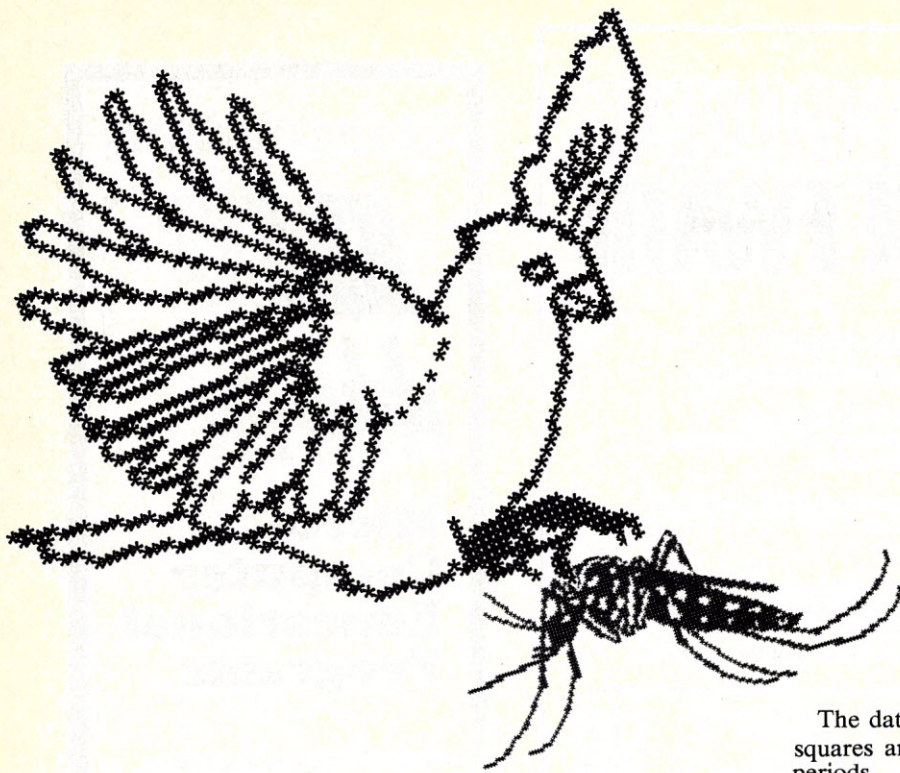
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The data is entered a line at a time by putting the blank squares and filled squares into the text file as blanks and periods.

The next step is to print the picture using the printer plotting program. The actual height and width parameters will be dependent on your printer. For the Diablo 1620, a small picture can be printed by using 2,4 for height, width and a period for the character. For a larger picture use 3,6 for height, width and an asterisk for the character. Note that the width should be about twice the height for the same horizontal and vertical distance between characters. You can experiment to see what happens with other values.

#### Some Other Considerations

These pictures have a tendency to take up lots of disk space in their raw form. A method to shrink the size of the data files can be used in conjunction with a modified printing program to save space. One method is to store each line as a list of numbers. This list is formed by taking the number of blanks, the number of dots, the number of blanks, number of dots, ... ending with the number of dots. This method will reduce a 16K file to 3K.

Another method for reducing your data file is to represent it as one decimal digit for each eight binary digits (blanks=0, dots=1). This is less convenient because it is more complicated to produce and then to convert to printable form. This method reduces the file size to about one seventh of the original size.

For example, suppose this was a line of your data file.

1234567890123456789012345678901234567890

0000111000111101101010100110011111010

In the first reduced form the data line would look like:  
4,3,3,4,3,1,1,1,1,2,2,2,6,1,1.

In the first reduced form the data line would look like:  
4,3,4,1,3,1,1,1,1,2,2,2,6,1,1.

In the second reduced form, the data line would look like:  
14,61,213,153,250.

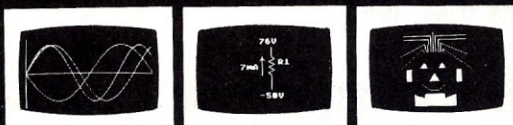
In addition to the Diablo 1620 printer, we use a North Star Horizon 2 with double density drives and a Hewlett Packard 2621A terminal. The program was written using the Microsoft Basic 80 Compiler with CP/M. An earlier version of the program was written in CBasic2. □





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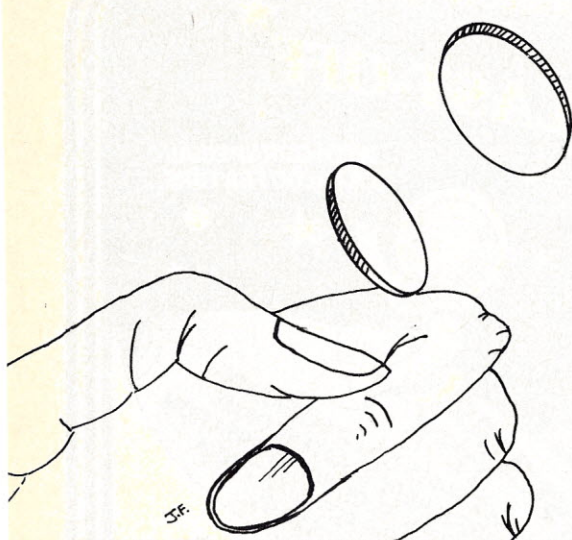
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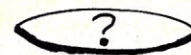




# How to Solve It— With the Computer

**Donald T. Piele**

## Part Four—Probability



*"To sum up, we can ascertain that, approximately, the frequency of an event is to the number of all observations as the probability of the event is to the probability of the certainty, i.e., to 1. I find this correspondence between facts and logic, between possibility and realization, wonderful, indeed!"*

*Blaise Pascal (1654)*

The development of the theory of probability is a comparatively young branch of mathematics which historians believe began with a series of letters between Pascal and Fermat in 1654. Motivated by his interest in the gambling problems suggested to him by his friend, the Chevalier de Mere, Pascal formulated many of the fundamental principles of this new science — which we now take for granted. Even the most basic idea of using a number between 0 and 1 to represent the probability of an event had not been formulated before. It was Pascal who suggested "... the most natural procedure is always to assign the number 1 to the complete certainty and to measure the degree of certainty of a random event with the fraction giving the event's share of the complete certainty."<sup>1</sup>

Pascal's letters were published for the first time in the small paperback, *Letters On Probability*,<sup>1</sup> in 1972. At the time they were written, more than 300 years earlier, it was not completely clear whether the study of the randomness was indeed a branch of mathematics. "If by mathematics one understands its traditional capital stock only, geometry, arithmetic, and algebra, there is naturally in this narrow definition no room for any new branch." I agree in this respect with Descartes, however, according to whom every study having for its aim the investigation of measure and order belongs to mathematics irrespective of the object whose measure and order it investigates.

### Computers In Mathematics

Today, the network of fields linked to mathematics by this definition are huge. In fact, it is hard to exclude any area of human endeavor that does not ultimately encounter problems of measure and order. In a similar way, computers were originally designed to solve a very narrow class of computational problems in ballistics. Today, less than 35 years later, it is difficult to exclude any area of human endeavor that does not benefit by the rapid computation of measure and order provided by computers.

At the same time that computers have become indispensable tools for solving problems of measure and order, they have expanded the ways we traditionally solve problems and they have provided a completely new environment for developing the art of problem solving.

### Programming Activities

This month's activities will be taken from the world of probability. For the beginning student, I will introduce problems that use the random number generator — a function that plays an indispensable role in many computer simulations. The use of relative frequency as a measure of the probability of an event will be explored in problems for the intermediate student. Finally, the average value for the number of tries necessary to write a bug-free program will be explored by the advanced students.

### Lesson #4 (Beginning Students)

In the last lesson (#3), I posed the problem of writing a program for the Apple II that would fill the screen with a single color. The intent of this problem was to introduce the FOR-NEXT statement. Now the problem will be to carry out a similar procedure in a completely random fashion.

The commonly used random number function used in Basic is denoted by RND(1). On the Apple II with Applesoft Basic, RND(1) returns a random number between 0 and 1 every time it is encountered in the program. A simple program illustrates how this works.

```
10 PRINT RND(1)
20 GOTO 10
30 END
```

```
RUN
.53345678
.876347891
.293018028
.....
```

Unfortunately, the program must be stopped (Break/CRTLC) to read the numbers because they appear on the screen so fast. For better control of the output, I use the following program which generates 10 random numbers; the numbers multiplied by 10; and then the integer part of the numbers multiplied by 10. The following program illustrates how to use the random number generator to pick single digits at random.

```
10 REM RANDOM NUMBER
20 REM APPLESOFT BASIC
30 FOR I=1 TO 10
40   X=RND(1)
50   PRINT X, 10*X, INT(10*X)
60 NEXT I
70 END
```

```
RUN
.34753094    3.4753094    3
.89234103    8.9234103    8
.25345630    2.5345630    2
.....
```

<sup>1</sup>Donald Piele, University of Wisconsin-Parkside, Kenosha, WI 53141



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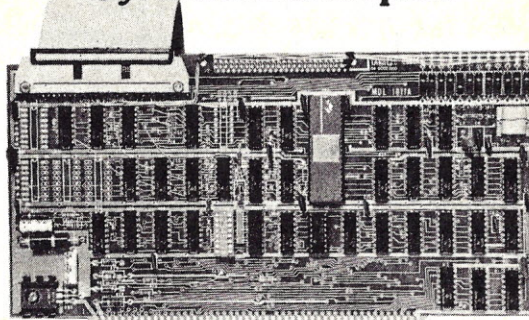
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## Solve it, continued...

Integer Basic on the Apple II generates only integers, and thus the RND(X) function has a slightly different meaning. In this case RND(X) generates an integer between 0 and X-1 inclusively every time it is encountered in the program. For example, to perform the same task as above in Integer Basic, use:

```
10 REM RANDOM INTEGERS
20 REM INTEGER BASIC
30 FOR I= 1 TO 10
40   PRINT RND(10),
50 NEXT I
60 END
```

As illustrated in lesson #3, positions on the low-resolution graphics screen are located by pairs X,Y where both X and Y are integers between 0 and 39 inclusively. Thus, to pick an integer in this range at random in Applesoft Basic use INT(40\*RND(1)). In Integer Basic, RND(40) accomplishes the same thing.

### Problem #4 (Beginning Students)

Write a program that fills up the screen with a solid color by plotting the points at random.

#### Remarks

1. What does it mean to plot points on the screen at random? Discuss this question with the class and see what they think it means. As illustrated above, every point on the screen is represented by a pair of integers (X,Y) where X and Y are between 0 and 39 inclusively. If X and Y are chosen at random in this range then the point X,Y is a random point on the screen.

2. A sample solution in Applesoft Basic is:

```
10 GR
20 COLOR=9
30 X=INT(40*RND(1))
40 Y=INT(40*RND(1))
50 PLOT X,Y
60 GOTO 30
70 END
```

3. For Integer Basic lines 30 and 40 will need to be replaced by

```
30 X=RND(40)
40 Y=RND(40)
```

4. The program is caught in an endless loop which can be terminated by using the familiar CTRL C.

5 After the students have written a Basic solution to this problem I like to pose a number of follow-up questions.

a) What happens if we replace line 30 with "30 X = 20"?

[A vertical line in the middle of the screen is filled at random.]

b) What happens in the original program if we replace line

40 with "40 Y = 20"?

[A horizontal line in the middle of the screen is filled at random.]

c) What happens in the original program if we replace line

50 with "50 PLOT X,X"?

[The diagonal line from the upper left to the lower right of the screen is filled at random.]

d) What happens in the original program if we replace line

60 with "60 GOTO 40"?

[A random horizontal line is filled at random.]

e) What happens in the original program if we replace line

20 with 20 COLOR=INT(16\*RND(1)) and line 60 with 60 GOTO 20.

[The screen is plotted at random with random colors.]

### Lesson #4 (Intermediate Students)

The simplest example of relative frequency is illustrated by the experiment of flipping a coin a fixed number of times and counting the number of heads and tails that appear. Let H be

the variable that counts the number of heads and let N be the total number of tosses. The relative frequency of the occurrence of heads is defined to be  $H/N$ . Anyone who has tried this experiment with a fair coin recognizes a certain predictable behavior: The relative frequency  $H/N$  is close to  $1/2$  and seems to get closer the longer the experiment is performed.

This experiment can be simulated on the computer by making the random number generator act like a coin. Random numbers generated in Basic use a procedure that picks out numbers uniformly over the interval (0,1). This means that, on the average, half the numbers are less than .5. Thus, by using the statement

IF RND(1) < .5 THEN H = H + 1

the counter H (heads) is increased by one about 50% of the time. If the chances of a head is P, ( $0 \leq P \leq 1$ ), then the statement

IF RND(1) < P THEN H = H + 1

will increment the counter H by one approximately  $P \cdot 100\%$  of the time.

These ideas can be put together into a simple Coin Tossing Experiment. In this experiment the probability of a head is assumed to be .5. A coin is tossed 1000 times and after every 50 tosses the total number of trials (C), the number of heads (H), and the relative frequency (H/C) are reported.

```
100 PRINT "COIN TOSSING EXPERIMENT "
110 PRINT "===== "
120 PRINT "TOSSES", TAB(7), "HEADS", TAB(14),
    "HEADS/TOSSES"
130 FOR I=1 TO 20
140   X=RND(-1)           \REM RANDOM SEED
150   X=RND(0)            \REM RANDOM NUMBER
160   C=C+1               \REM TOTAL TOSSES
170   IF X < .5 THEN H=H+1
180   IF C/50 <> INT (C/50) THEN 150
190   PRINT C, TAB(7), H, TAB(14), H/C
200 NEXT I
210 END
```

```
RUN
COIN TOSSING EXPERIMENT
=====
TOSSES HEADS HEADS/TOSSES
50      30      .6
100     51      .51
150     76      .50666667
200    105      .525
250    129      .516
300    152      .50666667
350    182      .52
400    203      .5075
450    227      .50444444
500    252      .504
550    274      .49818182
600    300      .5
650    328      .50461538
700    355      .50714286
750    384      .512
800    416      .52
850    438      .51529412
900    462      .51333333
950    484      .50947368
1000   504      .504
```

#### Remarks

1. The form for the random number generator is not standard in all Basics. This program was written in NorthStar Basic. In Applesoft Basic one should use 150 X=RND(1) to generate the next random number.

2. Line 140 is used to start the program with a random seed value. This is usually handled differently in different Basics. Some Basics use the statement 140 RANDOMIZE. In Applesoft Basic this is equivalent to

140 X = RND(-PEEK(78)-256\*PEEK(79)).

3. Line 180 is used to interrupt the experiment after every 50 tosses and print out the current value for C, H, and H/C.



# Economic and Ecology Simulations

The Ecology Simulations series are a unique educational tool. They are based on "simulation models" developed by the Huntington Two Computer Project at the State University of New York at Stony Brook under the direction of Dr. Ludwig Braun. The programs and accompanying documentation are written for self-teaching or classroom use and include background material, sample exercises and study guides. Graphic displays were specially developed by Jo Ann Comito at SUNY and Ann



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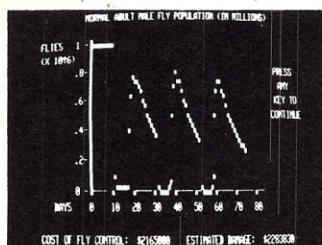
## Ecology Simulations-1, CS-3201 (16K)

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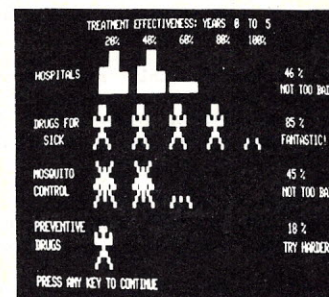
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## Ecology Simulations-2, CS-3202 (16K)

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an apartment building or an entire city.



### 3. Malaria

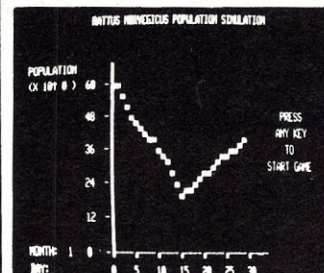
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Market allows two or more people to play the roles of companies who are competing

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Each player makes marketing decisions quarterly including the production level, the advertising budget, and the unit price of the product for his/her company.

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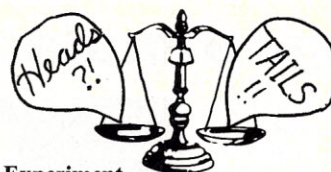
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## Solve it, continued...



### Geometric Experiment

A completely different experiment can be performed by observing a series of coin tosses. Suppose instead of counting the number of heads and tails we count the number of tosses until a head occurs for the first time. This defines a new experiment called the First Head Experiment. Every time the experiment is performed we observe a number — which represents the total number of tosses needed to get a head for the first time. Thus, the outcomes of this experiment are recorded as follows.

EXPERIMENT	OUTCOME
H	1
TH	2
TTH	3

In this experiment, if we assume that the probability of getting a head on each toss is  $P$ , then the probability for a tail is  $1-P$ . Under these conditions, this experiment has a Geometric distribution which I will elaborate later.

### Problem #4 (Intermediate Student) First Head Experiment

Write a program that will simulate the experiment of tossing a coin until the first head occurs. The program must allow for the entry of the probability  $P$  of a head on each toss. Perform the experiment 1000 times and keep track of the number of experiments that end after  $T$  tosses,  $T = 1, 2, 3, \dots, M$ . ( $M$  is the largest number of tosses needed so far.) Print out a table after every 100 experiments showing the distribution of the outcomes that end after  $T$  attempts and the relative frequency for each value of  $T$ .

#### Remarks:

1. The heart of this simulation is a routine that will simulate the tossing of the coin until the first head. Suppose the counter  $T$  is used to store the number of trials until the first head and that  $P$  is the probability of a head on each toss. The following few lines simulate this experiment.

```
.....
240 T = 0          T = TRAIL #
250 X = RND(0)     TOSS COIN
260 T = T + 1      INCREMENT TRIAL
270 IF X > P THEN 250 TOSS IS A TAIL
....              1st HEAD OCCURS
```

2. The 250-270 loop terminates whenever the random number  $RND(0)$  is less than  $P$ . This corresponds to the occurrence of a head.

3. It is convenient to use an array, such as  $C(T)$ , to keep track of the number of times the experiment ends after  $T$  trials. Each time the experiment ends after  $T$  tosses, it is counted by  
290  $C(T) = C(T) + 1$ .

4. If  $N$  is equal to the total number of experiments performed, then  $C(T)/N$  is equal to the relative frequency of the number of experiments that end after  $T$  trials.

5. If  $N/100 = INT(N/100)$ , then  $N$  is a multiple of 100. A version of this test is used to print out the distribution after every 100 experiments.

6. A sample program that solves this problem is as follows.



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SYNC magazine is different from other personal computing magazines. Not just different because it is about a unique computer, the Sinclair ZX80 (and kit version, the MicroAce). But different because of the creative and innovative philosophy of the editors.

## A Fascinating Computer

The ZX80 doesn't have memory mapped video. Thus the screen goes blank when a key is pressed. To some reviewers this is a disadvantage. To our editors this is a challenge. One suggested that games could be written to take advantage of the screen blanking. For example, how about a game where characters and graphic symbols move around the screen while it is blanked? The object would be to crack the secret code governing the movements. Voila! A new game like Mastermind or Black Box uniquely for the ZX80.

We made some interesting discoveries soon after setting up the machine. For instance, the CHR\$ function is not limited to a value between 0 and 255, but cycles repeatedly through the code. CHR\$(9) and CHR\$(265) will produce identical values. In other words, CHR\$ operates in a MOD 256 fashion. We found that the "=" sign can be used several times on a single line, allowing the logical evaluation of variables. In the Sinclair, LET X=Y=Z=W is a valid expression.

Or consider the TL\$ function which strips a string of its initial character. At first, we wondered what practical value it had. Then someone suggested it would be perfect for removing the dollar sign from numerical inputs.

Breakthroughs? Hardly. But indicative of the hints and kinds you'll find in every issue of SYNC. We intend to take the Sinclair to its limits and then push beyond, finding new tricks and tips, new applications, new ways to do what couldn't be done before. SYNC functions on many levels, with tutorials for the beginner and concepts that will keep the pros coming back for more. We'll show

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```

100 PRINT "FIRST HEAD EXPERIMENT"
110 PRINT "=====
120 PRINT "THE TOSS OF A COIN RESULTS IN EITHER A HEAD OR A TAIL."
130 PRINT "THE PROBABILITY OF HEADS IS THE NUMBER P."
140 PRINT "AN EXPERIMENT CONSISTS OF TOSSING A COIN UNTIL THE FIRST HEAD OCCURS."
150 PRINT "THE OUTCOME OF THE EXPERIMENT IS THE NUMBER OF TOSSES NEEDED."
160 PRINT
170 PRINT "THIS EXPERIMENT IS PERFORMED 1000 TIMES AND THE DISTRIBUTION "
180 PRINT "OF TOSSES IS REPORTED AFTER EVERY 100 EXPERIMENTS."
190 PRINT
200 INPUT "ENTER P THE PROBABILITY OF A HEAD ON EACH TOSS, P = ",P
210 DIM C(100)
220 X=RND(-1) \ REM RANDOM SEED
230 FOR J=1 TO 10
240 T=0 \ REM T = # OF TRIALS UNTIL FIRST HEAD
250 X=RND(0)
260 T=T+1
270 IF X>P THEN 250 \ REM THE TOSS IS A TAIL
280 N=N+1 \ REM EXPERIMENT COUNTER
290 C(T)=C(T) + 1 \ REM OUTCOME COUNTER
300 IF T>M THEN M=T \ REM M = MAX # OF TRIALS IN ANY EXPERIMENT
310 IF N/100<>INT(N/100) THEN 240
320 \ REM PRINT OUT OF RESULTS
330 PRINT
340 PRINT "TRIAL",TAB(10),"# OF EVENTS",TAB(25),"RELATIVE FREQUENCY"
350 FOR I=1 TO M
360 PRINT I,TAB(10),C(I),TAB(25),C(I)/N
370 NEXT I
380 PRINT "=====
390 PRINT "TOTALS",TAB(10),N,TAB(25),1
400 NEXT J
410 END

```

```

RUN
FIRST HEAD EXPERIMENT
=====

```

```

THE TOSS OF A COIN RESULTS IN EITHER A HEAD OR A TAIL.
THE PROBABILITY OF HEADS IS THE NUMBER P.
EACH EXPERIMENT CONSISTS OF TOSSING A COIN UNTIL THE FIRST HEAD OCCURS.
THE OUTCOME OF THE EXPERIMENT IS THE NUMBER OF TOSSES NEEDED.

```

```

THIS EXPERIMENT IS PERFORMED 1000 TIMES AND THE DISTRIBUTION
OF TOSSES IS REPORTED AFTER EVERY 100 EXPERIMENTS.

```

```

ENTER P THE PROBABILITY OF A HEAD ON EACH TOSS, P = .5

```

```

(ONLY THE LAST DISTRIBUTION IS PRINTED HERE)

```

TRIAL	# OF EVENTS	RELATIVE FREQUENCY
1	501	.501
2	245	.245
3	127	.127
4	62	.062
5	33	.033
6	17	.017
7	3	.003
8	6	.006
9	5	.005
10	1	.001
=====		
TOTALS	1000	1

#### Lesson #4 (Advanced Students)

The First Head Experiment serves as an introduction to a slightly different experiment which I will call the Bug-Free Program Experiment. As everyone who has ever tried to write a computer program knows, the chances that it will run correctly on the first trial is definitely below 1. We also know from experience that the chances of eliminating bugs usually improves the more times the program is modified and tried again. I will assume, for the purposes of this discussion, that the chances that a program will run perfectly (bug-free) on the Tth trial is equal to  $T/(T+1)$ . Thus,

$$P(S) = T/(T+1) \text{ and}$$

$$P(F) = 1/(T+1),$$

where  $P(S)$  stands for the probability of a successful program on the Tth trial and  $P(F)$  represents the probability of a failure on the Tth trial.

This experiment is similar to the First Head Experiment described above, with one big difference. Now the probability of a success depends on the number of times the experiment has been tried. The outcome of this experiment is still the num-

ber of trials until the first success.

With this model it seems natural to wonder: How many trials, on the average, will it take to produce a bug-free program? In the language of probability, what is the expected value of the outcomes in this experiment?

The average value of the outcomes of an experiment is easy to compute. For example, assume that the outcomes of an experiment are the integers  $T$ ,  $T = 1, 2, \dots, M$ . Also, assume that  $C(T)$  counts the number of times  $T$  occurred. Then the average number of times that  $T$  occurs in  $N$  trials is  $(C(1)+2*C(2)+\dots+M*C(M))/N$ .

#### Problem #4 (Advanced Students)

##### Bug-Free Program Experiment

Write a program that simulates the process of writing a program until it runs bug-free. The probability of success on the Tth trial should equal  $T/(T+1)$ . Perform the experiment 1000 times and keep track of the number of programs that run after  $T$  trials where  $T = 1, 2, 3, \dots, M$ . ( $M$  is the largest number of attempts needed so far.) Print out a table, after every 100 experiments, showing the distribution of outcomes that end after  $T$  attempts, the relative frequency for each value of  $T$ , and the average value of  $T$ .

##### Remarks:

1. It would be advisable for students to write the First Head Experiment program first. With a few changes and modifications this program can be used to solve the Bug-Free Program Experiment. For example: Line 200 will no longer be needed, since the probability of success on the Tth trial is no longer fixed at  $P$ . Line 270 should be changed to read: IF  $X > T/(T+1)$  THEN 250.

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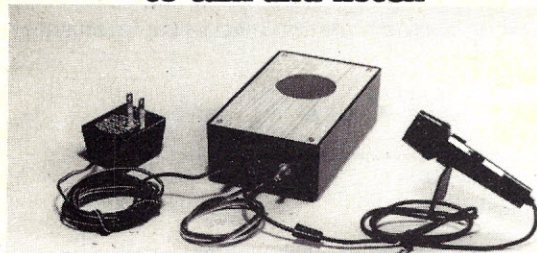
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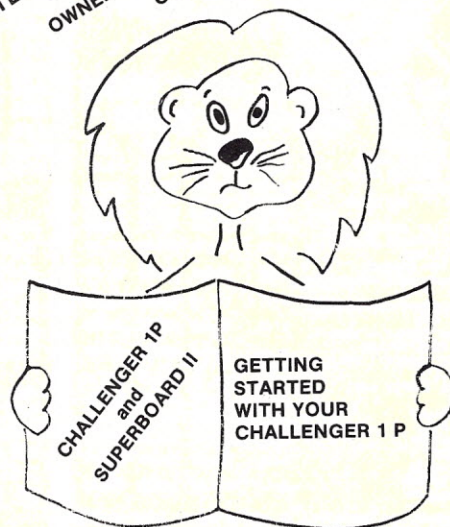
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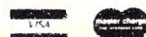


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## Solve it, continued...

2. To compute the average outcome in N experiments, the student will need to total all the outcomes. This can be done with a statement such as  $S = S + I * C(I)$  placed in the printout loop. The average value then is  $S/N$ .

3. This same average number computation could also be added into the First Head Experiment.

4. For added interest, ask students to keep track of how many attempts were made to write the Bug-Free Experiment program. Have the class make a chart of this distribution and compare it with the outcome of the Bug-Free Program experiment.

## Postscript

This section is added for those interested in a more detailed mathematical treatment of the two experiments.

The First Head Experiment is an application of the Geometric distribution.<sup>2</sup> Before I go further, some notation may be helpful.

Notation	Meaning
H	Heads
T	Tails
$P(H) = p$	Probability of heads = p
$P(T) = 1-p$	Probability of tails = 1-p
q	$q = 1-p$
TTTTH	First head is on 5th trial.
$P(TTTTH)$	Probability of the event.
X=5	First head is on 5th trial.
$P(X=5)$	Probability of the event.
E(X)	Average value of X.

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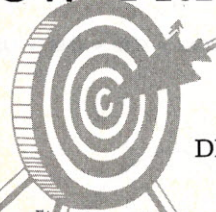
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```

100 PRINT "BUG-FREE PROGRAM EXPERIMENT"
110 PRINT "=====
120 PRINT "THE PROBABILITY THAT A PROGRAM IS BUG-FREE DEPENDS ON "
130 PRINT "THE NUMBER OF TIMES IT HAS BEEN REWRITTEN."
140 PRINT "EACH TIME IT IS RUN THE PROBABILITY THAT IT IS BUG "
150 PRINT "FREE IS EQUAL TO T/(T+1) WHERE T IS THE TRIAL NUMBER."
160 PRINT
170 PRINT "AN EXPERIMENT CONSISTS OF EDITING THE PROGRAM UNTIL IT RUNS."
180 PRINT "THE OUTCOME IS THE NUMBER OF TRIALS NEEDED TO MAKE IT WORK."
190 PRINT "THIS EXPERIMENT IS PERFORMED 1000 TIMES AND THE DISTRIBUTION "
200 PRINT "OF OUTCOMES IS REPORTED AFTER EVERY 100 EXPERIMENTS."
210 PRINT "THE AVERAGE NUMBER OF TRIALS NEEDED TO PRODUCE A BUG-FREE PROGRAM"
220 PRINT "IS COMPUTED."
230 PRINT
240 DIM C(100)
250 X=RND(-1)
260 FOR J=1 TO 10
270 T=0
280 X=RND(0)
290 T=T+1
300 IF X> T/(T+1) THEN 280
310 N=N+1
320 C(T)=C(T) + 1
330 IF T>M THEN M=T
340 IF N/100<>INT(N/100) THEN 270
350 REM PRINT OUT OF RESULTS
360 PRINT
370 PRINT "TRIAL",TAB(10),"# OF EVENTS",TAB(25),"RELATIVE FREQUENCY"
380 S=0
390 FOR I=1 TO M
400 PRINT I,TAB(10),C(I),TAB(25),C(I)/N
410 S=S+J*C(I)
420 NEXT I
430 PRINT "=====
440 PRINT "TOTALS",TAB(10),N,TAB(25),1
450 PRINT "AVERAGE VALUE ",S/N
460 NEXT J
470 END

```

RUN  
BUG-FREE PROGRAM EXPERIMENT

=====

THE PROBABILITY THAT A PROGRAM IS BUG-FREE DEPENDS ON  
THE NUMBER OF TIMES IT HAS BEEN REWRITTEN.  
EACH TIME IT IS RUN THE PROBABILITY THAT IT IS BUG  
FREE IS EQUAL TO T/(T+1) WHERE T IS THE TRIAL NUMBER.

AN EXPERIMENT CONSISTS OF EDITING THE PROGRAM UNTIL IT RUNS.  
THE OUTCOME IS THE NUMBER OF TRIALS NEEDED TO MAKE IT WORK.  
THIS EXPERIMENT IS PERFORMED 1000 TIMES AND THE DISTRIBUTION  
OF OUTCOMES IS REPORTED AFTER EVERY 100 EXPERIMENTS.  
THE AVERAGE NUMBER OF TRIALS NEEDED TO PRODUCE A BUG-FREE PROGRAM  
IS COMPUTED.

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TRIAL	# OF EVENTS	RELATIVE FREQUENCY
1	500	.5
2	335	.335
3	118	.118
4	39	.039
5	7	.007
6	1	.001

=====

TOTALS 1000 1  
AVERAGE VALUE 1.721



Since all tosses of the coin are independent of one another it is true that

$$P(TTTTH) = P(T)P(T)P(T)P(T)P(H) = q^4 p.$$

If X stands for the number of tosses until the first head appears, the following probability table applies.

Outcome X	Probability
1	p
2	$q^1 p$
3	$q^2 p$
...	...
i	$q^{i-1} p$

The average or expected outcome is determined by weighing each outcome by its probability.

$$E(X) = p + 2pq + 3pq^2 + \dots + ipq^{i-1} + \dots$$

It can be shown, [2], that the sum of this series is  $1/p$ . Thus in the First Head Experiment with  $p=1/2$ , the average outcome  $E(X) = 2$ .

### Bug-Free Program Experiment

The computation of the probability of each outcome is different for the Bug-Free Program Experiment. Let F represent failure and S represent success on each trial. The corresponding probabilities,  $P(F)$  and  $P(S)$ , depend on the number of trials T performed

$$P(S) = T/(T+1), \quad P(F) = 1/(T+1).$$

Thus the computation of the probability for the first success occurring on the 5th trial is

$$= \frac{1}{2} \cdot \frac{1}{3} \cdot \frac{1}{4} \cdot \frac{1}{5} \cdot \frac{5}{6} = \frac{5}{6!} \quad (! = \text{factorial})$$

If X stands for the number of trials of the program until the first success, then the following probability table applies.

Outcome X	Probability
1	$1/2$
2	$1/3$
3	$1/8$
...	...
i	$i/(i+1)!$

The average or expected number of trials for this experiment is computed by weighing each outcome with its probability.

$$E(X) = 1/2 + 2(1/3) + 3(1/8) + \dots + i(i/(i+1)!) + \dots$$

Each term of this series may be rewritten using the identity

$$i(i/(i+1)!) = i/i! - i/(i+1)!$$

After combining terms, the series can be reduced to

$$E(X) = 1 + 1/2! + 1/3! + 1/4! + \dots + 1/i! + \dots$$

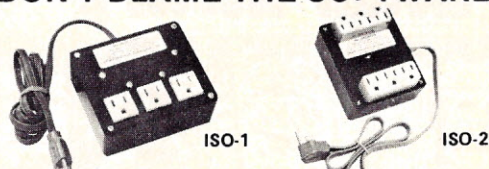
This familiar series is equal to  $e-1$ , where  $e$  is approximately 2.7182817. Thus, using this model, the average number of times that a computer program will need to be debugged is 1.7182817.

This is probably a well known exercise in probability, but for me it came as a delightful surprise. □

### REFERENCES

1. Rényi, Alfréd, *Letters On Probability*, Wayne State University Press, Detroit, 1972.
2. Meyer, Paul, *Introductory Probability And Statistical Applications*, p. 171, Addison-Wesley Publishing Co., 1970.

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The book will take you through everything programmers learn. Its easy to understand and the large type makes it easy to read. You'll find out how to put together a flowchart, and how to get your computer to do what you want it to do. There's a lot to learn, but **Computers For Kids** has 12 chapters full of information. You'll even learn how to write your own games and draw pictures that move.

Just so the folks and your teachers won't feel left out, there's a special section for them. It gives detailed lesson ideas and tells them how to fix a lot of the small problems that might pop up. Hey, this book is just right for you. But you don't

have to take my word on that. Just listen to what these top educators have to say about it:

Donald T. Piele, Professor of Mathematics at the University of Wisconsin-Parkside says, "**Computers For Kids** is the best material available for introducing students to their new computer. It is a perfect tool for teachers who are learning about computers and programming with their students. Highly recommended."

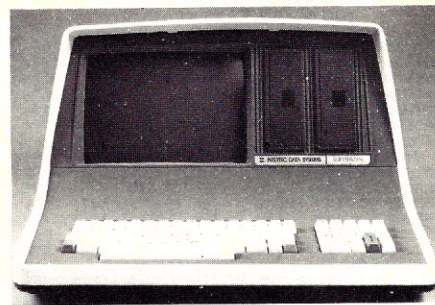
Robert Taylor, Director of the Program in Computing and Education at Teachers College, Columbia University states, "it's a good idea to have a book for children."

Not bad, huh? Okay, you can let the adults back in the room. Don't forget to tell them **Computers For Kids** by Sally Greenwood Larsen cost only \$3.95. And tell them you might share it with them, if they're good. Specify edition on your order: TRS-80 (12H); Apple (12G); Atari (12J).

Your local computer shop should carry **Computers For Kids**. If they don't ask them to get it or order by mail. Send \$3.95 payment plus \$1.00 shipping and handling to Creative Computing Press, P.O. Box 789-M, Morristown, NJ 07960.

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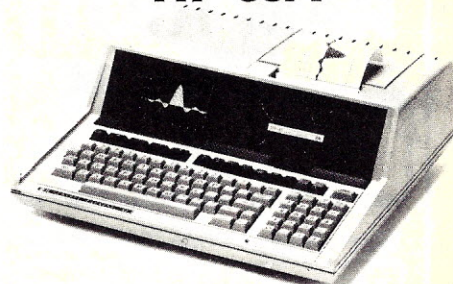
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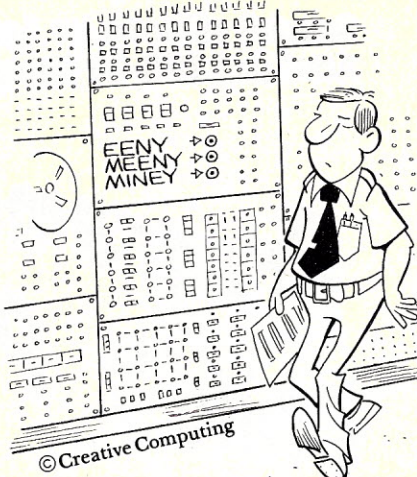
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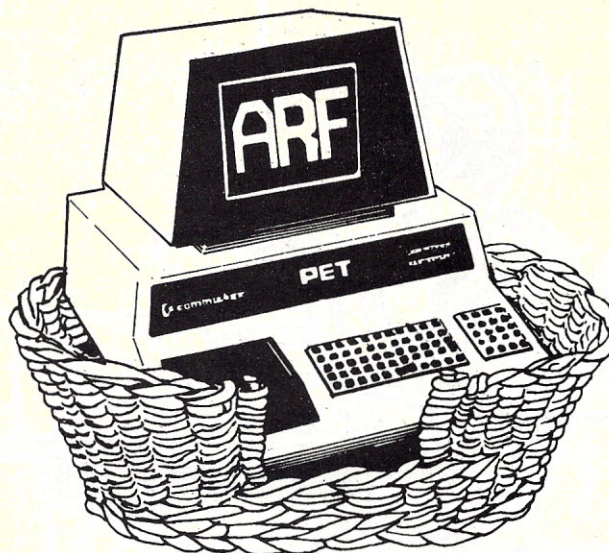
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# Personal Electronic Transactions

by Gregory Yob



I am happy to hear from you, and encourage your correspondence. I will try to acknowledge all correspondence, and a SASE makes things easier for both of us. Please send your letters to "Personal Electronic Transactions" c/o PO Box 354, Palo Alto, CA 94301.

## A List Program For Non-PET Printers

A long time ago, as time is seen in small computers, I took a look at how the Basic was stored in the PET, and came up with a program which listed itself. (See Sept 79 Column) In the last several columns an undesirable number of typos have crept in, probably because I am too lazy to re-enter a program to see if it works. To combat this, I will now use genuine listings (via my listing program) for any programs longer than a few lines.

Program 1 shows my listing program as set to list itself. This program should work with almost any full ASCII printer, and with minor changes, on any printer that can print the letters and numbers, such as a Teletype (TM). Operation of the program is simple. First, LOAD the program you want to list. Then, using the Programmer's Toolkit APPEND (or Disk-O-Pro's MERGE), append the PRINTER LIST program. When your printer is ready, a RUN 63000 will do the job. The screen will clear and ask for:

PGM NAME:?

which lets you enter a little line of some kind. The printer will then list the program, NOT including the Printer List portion.

PRINTER LIST is written to save as much space as possible (Some of you out there will find ways to save a few bytes, I am sure.) and as a result will look a bit obscure. Let's take a short walk through the program to shed some light on this. If you don't know how Basic is put together, I refer you to the Sept 79 column mentioned earlier.

FNF in Line 63000 computes the value of a pointer at X. That is, if addresses X and X+1 are a pointer, FNF figures out

the pointer's value. P is set up to the first pointer in a Basic program which is usually at 1025. (Some creative types will change the Bottom-of-Basic pointer to pick up the 191 bytes in the Second Cassette Buffer. Be duly warned.) T\$ is set to the tilde (~) character in ASCII.

The unusual string in the DATA statement, \- ← \, was chosen to be a string which is not likely to appear in any program. Line 63010 reads any DATA lines in the program to be listed and will stop with the DATA pointer just past this unusual string.

This is a cheap way to do the equivalent of RESTORE 63010 which is not available on the PET.

The string P\$ is set to the ASCII Lower Case letters "sp", Q\$ is set to "pi". There is no direct way to set these characters in the PET, as the values 96 to 127 are not enterable via the keyboard. In Line 63020, the string array S\$ is defined and loaded with the 75 Basic token names END ... GO. These names are in the DATA statements in Lines 63050-63090. (Note: The "new" PET ROMs have the GO token

### PROGRAM 1 - PRINTER LIST

```

63000 DEFFNF(X)=PEEK(X)+256*PEEK(X+1):P=1025:T$=CHR$(126):DATA\_←\
63010 READN$:IFN$<"\_←\" THEN63010
63020 P$=CHR$(115)+CHR$(112):DIMS$(75),C$(9),C$(9):FORJ=0TO75:READS$(J):NEXT
63030 Q$=CHR$(112)+CHR$(105):R$=CHR$(13):S$="sp ":FORJ=0TO9:READC$(J),N$
63040 FORK=1TOLEN(N$):C$(J)=C$(J)+CHR$(ASC(MID$(N$,K))+32):NEXTK,J
63050 DATAEND, FOR, NEXT, DATA, INPUT$, INPUT, DIM, READ, LET, GOTO, RUN, IF, RESTORE, GOSU
B
63060 DATARETURN, REM, STOP, ON, WAIT, LOAD, SAVE, VERIFY, DEF, POKE, PRINT$, PRINT, CONT
63070 DATA LIST, CLR, CMD, SYS, OPEN, CLOSE, GET, NEW, TAB(, TO, FN, SPC(, THEN, NOT, STEP, +,
-
63080 DATA*, /, ↑, AND, OR, >, =, <, SGN, INT, ABS, USR, FRE, POS, SQR, RND, LOG, EXP, COS, SIN, T
AN
63090 DATA TN, PEEK, LEN, STR$, VAL, ASC, CHR$, LEFT$, RIGHT$, MID$, GO
63100 DATA 147, CLR, 19, HM, 145, UP, 17, DN, 29, RT, 157, LFT, 146, INS, 20, DEL, 18, RV, 146, 0
FF
63110 INPUT"clr PGMsp NAME:":N$:OPEN 4,4:PRINT#4,CHR$(30)R$R$R$R$N$R$
63120 N=FNF(P+2):T=P+4:P=FNF(P):IFN=63200THENEND
63130 PRINT#4,N"sp ":Q=0:GOSUB63140:PRINT#4:GOTO63120
63140 C=PEEK(T):IFC=0THENRETURN
63150 GOSUB63160:GOTO63140
63160 T=T+1:IFC=34THENQ=Q+1AND1
63170 IFQTHEN63220
63180 IFC=255THEN63230
63190 IFC>203THENC=42
63200 IFC<128THENPRINT#4,CHR$(C):RETURN
63210 PRINT#4,S$(C-128):RETURN
63220 IFC=32THENPRINT#4,P$S$:RETURN
63230 IFC=255THENPRINT#4,Q$S$:RETURN
63240 IFC<31ANDC<128THENPRINT#4,CHR$(C):RETURN
63250 IFC>159THENPRINT#4,T$:CHR$(C):RETURN
63260 FORJ=0TO9:IFC=C$(J)THENPRINT#4,C$(J)S$:RETURN
63270 NEXT:RETURN

```

NOTE THAT LINES 63050, 63070, 63080 AND 63100 WILL FIT ON YOUR PET, PROVIDED THAT YOU DON'T ENTER ANY SPACES.



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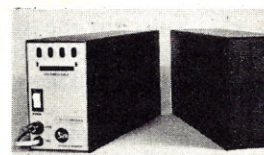
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## PET, continued...

added at the end of the tokens table. This will not influence listings done on "old" ROM PETs.) To save space, the strings R\$ and S\$ are set to the Return and Space characters, respectively. Note that on the listing, S\$="sp" really means: S\$=" ". The why of this will be explained later.

After the tokens are in place, the ten special characters (cursor movements and the like) are read into the arrays C% and C\$. The elaborate calculation in Line 63040 converts the upper case letters in N\$ to their ASCII lower case values and sticks the result into C\$. The result of this is the value in PET ASCII of a special character is found in C%() and its listing name in C\$().

The program proper (ie, after all this setting up) starts in Line 63110 where a little line is asked for under PGM NAME:. The OPEN then accesses the printer (my printer is IEEE device #4. If your printer is not on the IEEE bus, you will have to replace all of the PRINT#4 statements with a GOSUB to your printing routine.) We then print to the printer some carriage returns, the title line, and one more carriage return. Note that routine takes advantage of the PET's permissiveness on missing semicolons in PRINT statements. The CHR\$(30) is a peculiarity of my Comprint printer, which wants to see this character to leave its automatic pagination mode. (My printerbeast will do pagination at very inappropriate times unless I explicitly turn it off.) You can send any initialization for your printer, such as a form-feed, at this place.

Line 63120 computes the line number N from the line number stored after the Basic link pointer, and sets T to point at the first byte of the program line's text. P is then updated to look at the next line of program, and a test is applied to N.

**VERY IMPORTANT!** When you first use this program, change the end of Line 63120 to read: IF N=63000 THEN END. To list this program on my printer, I placed a REM at 63280 and changed Line 63120 to what you see here. 63000 is the first line in PRINTER LIST, and when it is seen, this test prevents the PRINTER LIST code from being listed.

Line 63130 prints the line number, N, and a space (here seen as "sp"). We then initialize Q, which is a flag for quote mode, and call Subroutine 63140 whose job is to actually list the contents of a line. Then a forced carriage-return via the PRINT#4 and on the next line via the GOTO.

At 63140, C is set to the current byte being scanned. A value of zero indicates the line is finished, so return. The job of Subroutine 63160 is to decide what to do with C. First, bump the pointer T up one, and then check C for quotation marks. (Quotes are CHR\$(34).)

The expression Q=Q+1AND1 is an

even/odd counter for the number of quotes found, with 0 for out-of-quotes mode and 1 for in-quote mode. At 63170 we decide if quotes are fashionable, and if so, skip to 63220.

Lines 63180-63210 handle non-quotes listing. First, the pi ( $\pi$ ) token is checked for, and the sequence Q\$\$\$ will print "pi" to the printer in Line 63230. Tokens larger than 203 (the largest token in non Basic 4 PETs) will force an asterisk as an indication that what is being listed is probably not a Basic program. In 63200, values below 128 are printed as they appear—things like TIS, for example. In 63210, we print the token's name by fetching the correct name from S\$. (You can't scramble the tokens order in S\$!)

Starting at 63220, we handle the in-quotes mode, which covers the string assignments, DATA and PRINT string literals. First we check for Space and Pi, and print these if found as "sp" or "pi". Values between 32 and 127 are printed as usual, as seen in Line 63240. If C exceeds 159, we know it to be a graphics character, and it is printed as the sequence (tilde) (PET Lower Case Equivalent). For example, the diamond (shift-Z) comes out as "~Z". The tilde warns of a shifted character.

All that's left to do are the special characters, checked for in Line 63260. Line 63270 provides a graceful exit if the special character isn't recognized.

One difference from my usual ways of typing a program is that the tilde will indicate a shifted character instead of an underline. As my typewriter does not have a tilde, I will still underline any short bits of program in the text of this column.

If you want to use some other representation of the PET's special characters, the change is easily made. Simply change the names in Line 63100, for example,

```
63100 DATA 147,CLEAR,19,HOME, .... (etc)
```

In line 63260, surround the CS() with some brackets, ie,

```
63260 FORJ=@T09:1FC=C%(J)THENPRINT#4,
      "[\"CS(J)\"]";:RETURN
```

We will now see cursor movements as (CLEAR), (HOME) and so on.

As a challenge, do a "look-ahead" in PROGRAM LIST which 1) counts the number of repeated characters for cursor movements and spaces only—so we see something like:

6-right 5-space  
appearing in the listing. When spaces are counted, if they appear between letters, like "HELLO OUT THERE" the listing gives us:

"HELLO OUT 2-space THERE"

I am sure this will keep you busy for an evening. Send me the results, I can use it!

### If You Really Want to Know About Your Program

Benson Greene, 210 Fifth Ave, New

York, NY 10010 sent me a program, *Proganal*, which reads a Basic program from tape (There's a *Diskanal* for disk systems too.), generates a listing and then produces several pages of reference information, including the variable names with the line numbers where these variables are found, a usage chart of the various Basic tokens, the line numbers where branches (jumps, GOSUBs and GOTOs) exist, and a summary of several statistics such as number of program lines, number of statements, etc. Benson will supply a tape of this program for \$10.00, if you also provide a SASE.

My feelings toward this program are mixed. First, it is an exercise in looking at the various parts of Basic program, and the reports are useful if you are looking at a program after a long time or at someone else's program. (Some programmers I know will do things like RENUMBER 1,1 just to be nice!) Second, *Proganal* takes a long time to run, generally 30 minutes or more for a program of any complexity. This is good night-time work for your PET.

On the other hand, *Proganal* isn't to be used much during the development of a program, due to the numerous changes that occur in most program debugging sessions. There is also a matter of skill—those of you who feel confident in Basic will probably not find many uses for *Proganal*. In any case, *Proganal* is of interest for programwriters, particularly in thinking of how *Proganal*'s functions might be done or improved.

There is one problem in computing which might be tackled with methods similar to those used in PROGRAM LIST and *Proganal*. Given a program with no INPUT or GET statements, determine if the program will stop executing. For example,

```
10 END
```

will definitely halt, and

```
10 GOTO 10
```

will definitely not halt.

Now for a curve ball: When testing your program, use the same program for analysis..... (those of you who know about this problem and its consequences are warned that this presentation is to encourage the rest of my readers to do some mental exercises.)

### The MONJANA/1 CBM ROM

If you have no interest in 6502 machine language, skip this review. The Monjana/1 is a 2k ROM which is installed in the \$9000 socket of "new" ROM PETs, and provides several facilities which assist the machine language programmer. (Available from Elcomp Publishing, 3873L Schaefer Ave, Chino, CA 91710 for \$98.00. Calif residents add 6% tax.) Figure 1 shows a printer dump of the Monjana's activity through several commands. (An interesting feature of this ROM is that its output can be sent to the



## GALAXY SPACE WAR I

Galaxy Space War 1 (WAR1) is a game of strategy in which the player has complete control of his space fleet's tactical maneuvers. Each fleet battles its way toward the opponents galaxy in an attempt to destroy it and win the war. WAR1 simulates the actual environment encountered in a space war between two galaxies. Optimum use is made of Apple's high resolution graphics (HIRES) and colors in displaying the twinkling stars universe, the colored ships of each fleet, long range sensors colored illuminations, and the alternating blinking colors used in battles between ships. Complementing HIRES are the sounds of war produced by Apple's speaker.

WAR1 is played between Apple and a player or between two players. You may play with total knowledge of each others fleet or only ships sensor knowledge of the opponents fleet. Each player builds his starting fleet and adds to it during the game. This building process consists of creating the size and shape of each ship, positioning it, and then allocating the total amount of energy for each ship.

During a player's turn he may dynamically allocate his ships total energy between his screen/detection and attack/move partitions. The percentage of the total energy allocated to each partition determines its characteristics. The screen/detection partition determines how much energy is in a ship's screens and the detection sector range of its short range sensors. The attack/move determines the amount of energy the ship can attack with, its attack sector range, and the number of sectors it can move in normal or hyperspace.

When an enemy ship is detected by short range sensors, it is displayed on the universe and a text enemy report appears. The report identifies the ship, its position, amount of energy in its screens, probable attack and total energy, a calculated detection/attack/move range, and size of the ship. Also shown is the number of days since you last knew these parameters about the ship. When a ship's long range sensor probes indicate the existence of an enemy presence at a sector in space, this sector is illuminated on the universe.

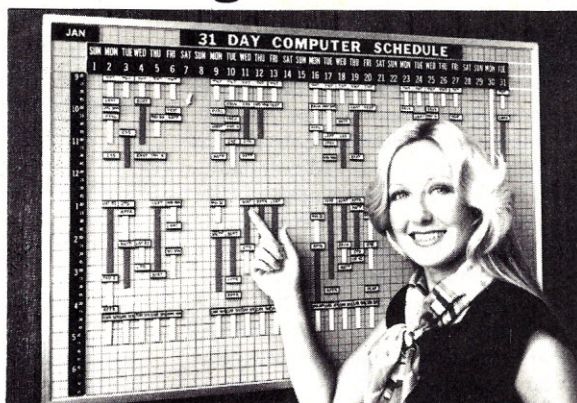
An enemy ship is attacked and destroyed with attack energy. If your attack energy breaks through his screens, then his attack energy is reduced by two units of energy for every unit you attack with. A text battle report is output after each attack. The program maintains your ship's data and the latest known data about each enemy ship. You may show either data in text reports or display the last known enemy positions on the universe. You can also get battle predictions between opposing ships. The text output calculates the amount of energy required to destroy each ship for different energy allocations.

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**CIRCLE 221 ON READER SERVICE CARD**



### PET, continued...

printer for later use, akin to CMD in Basic. This very useful function is one I haven't seen in several other monitors and assemblers.)

The first part is M (memory from \$9000 to \$9060—I might as well take a look at the ROM's code! The second part is a D (disassemble) of the same part of memory. The Monjana conveniently remembered the \$9000 to \$9060 from my M command, so only a carriage-return was needed after entering the D command. (Monjana commands first accept the letter, and then write on the screen to help you. For example, after entering M, we see: \*M 0000-0000 with the cursor in the first 0.) The third part is after N (note) which permits comments on the printer.

The fourth part is a trace, here showing the jump forced by the PET if started in address \$0000. At \$D123 lives the PET's Monitor, and we see the beginning of the Monitor's operation.

An unusual (though necessarily limited) feature is that of relocation and relinking. The relocation will change all jumps and JSR's to be compatible with the new location for a program, and the linking will patch any local addresses (such as in LDA) which refer to locations in the moved area. Provided you avoid complex tricks like setting the stack and then using RTS to do a jump for you, the relocation should work reasonably well.

One negative aspect of the Monjana is the \$100 price tag. This seems a bit steep to me, as the Programmer's Toolkit (of at least as much use) runs from \$50 to \$80.

## A Big Keyboard If You Need It

Though the majority of PETs now have the full size keyboard, there are still many machines which lack this grace. Century Research & Marketing will provide you with a full sized keyboard for \$139.95. (Century Research & Marketing, 4815 West 77th Street, Minneapolis, Minn, 55435.)

I installed the keyboard on my PET (all of 3 minutes to do) and have used it regularly for 3 months. Once you are used to the layout—some of the keys, such as RUN/STOP are in slightly different positions—the speedup possible with a full keyboard is quite valuable. On the numeric pad, the ?, Space, Return and Shift keys are duplicated to assist you in data entry. (The ? for PRINT in calculator mode.)

The plastic case of the keyboard looks flimsy, but I find that it stands up well. The special function keys (cursor movements, Shift, and so on) are in blue for rapid location. The keyboard is less bulky than the other unit available (Skyles Big Kbd, which is no longer in production, though a few are still in stock. Call 415 965-1735)

So, if you need it, get it—Manufacturers of PET keyboards face a declining market.

and soon your choice will be limited to building a "homebrew" unit. (I've done that one too....)

## Hangmath Returns

In the May 1980 column I described a program, *Hangmath*, and some improvements to make the program more playable and enjoyable. The job wasn't complete, however, and Paul Agosta sent me an improved version which provides a report

of past guesses and (I'm impressed!) draws the gallows, etc. on the right side of the screen. Program 2 shows the improved version of *Hangmath* for your enjoyment. (And as an exercise in reading the output of PRINTER LIST.)

Do try it out—the improvements are worth seeing. Deliberately lose a game to see the animation—simple, and effective. Perhaps Creative Computing Software would be interested in this? ☐

## HANGMATH AS IMPROVED BY PAUL AGOSTA

[illegible]





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| <input type="checkbox"/> 01401 | <input type="checkbox"/> 02501 | <input type="checkbox"/> 03403 | <input type="checkbox"/> 03440 | <input type="checkbox"/> 04504 | <input type="checkbox"/> 05108 | <input type="checkbox"/> 07301  |
| <input type="checkbox"/> 01403 | <input type="checkbox"/> 02503 | <input type="checkbox"/> 03404 | <input type="checkbox"/> 03444 | <input type="checkbox"/> 04513 | <input type="checkbox"/> 05203 | <input type="checkbox"/> 07809  |
| <input type="checkbox"/> 01404 | <input type="checkbox"/> 02601 | <input type="checkbox"/> 03408 | <input type="checkbox"/> 03484 | <input type="checkbox"/> 04609 | <input type="checkbox"/> 05208 | <input type="checkbox"/> 08609  |
| <input type="checkbox"/> 01407 | <input type="checkbox"/> 02701 | <input type="checkbox"/> 03409 | <input type="checkbox"/> 03504 | <input type="checkbox"/> 04804 | <input type="checkbox"/> 05308 | <input type="checkbox"/> 08709  |
| <input type="checkbox"/> 01413 | <input type="checkbox"/> 03304 | <input type="checkbox"/> 03410 | <input type="checkbox"/> 04501 | <input type="checkbox"/> 04909 | <input type="checkbox"/> 05409 | <input type="checkbox"/> 5681 8 |

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## Memory Dump

## Disassembly

## Note To Printer

N:THIRD MONJANA EXAMPLE

## Trace

```

504 IFZ$=Q$(N)THENM$=""YOUsp GUESSEDsp THATsp BEFORE":GOSUB3500;GOTO500
520 IFZ$=MID$(F$,N+1,1)THENG000
530 W=W+1:Q$(N)=Z$:GOSUB5000
531 .IFW=1THEN PRINT"up up sp sp sp sp sp sp sp sp sp sp YOURsp GUESSESDn
lft lft lft lft lft lft lft lft ~~~~~~"
532 PRINTTAB(W#10-10);Z$;"sp =";N;
533 .IFW=12THEN1000
535 GOT0500
N1=50:F0R X=0T04:F0RY=1T05
610 IFE$(X,Y)=Z$THENES(X,Y)="lft "+STR$(N):CK$(N)=Z$:K(N)=N
620 IFE$(X,Y)=""THENG800
630 M=ASC(E$(X,Y))
632 IFM=157THENN1=M
640 IFM>N1THENN1=M
680 NEXTY:NEXTX
682 IFN1<60THEN700
690 PRINT:GOT0400
700 PRINT"d n sp sp sp sp sp sp *****sp sp sp sp s
p sp sp sp sp sp sp dn "
702 PRINT"sp sp sp sp sp sp YOUsp GOTsp ITsp sp sp sp
sp sp sp sp sp ":GOT01042
710 PRINT"up sp sp sp sp sp YOUsp HAD"W*MISTAKEsp sp sp sp sp
sp sp sp sp "
720 T1=T1+W:U=U+1:T2=T2+W*W
730 PRINT"d n sp sp sp AVERAGEsp AFTERsp "U*GAME(S)sp IS"INT((T1/U)+.5)"I
ft sp sp dn ";XX$
750 PRINT"dn sp sp sp ANOTHERsp GAMEsp ?sp ";
755 GOSUB3000
760 IFA$=""Y"THENS91
764 IFA$(>)N"THEN755
770 PRINTS$;"d n S0sp LONGsp !!sp sp sp sp sp ":END

1000 REM SOLUTION SUBROUTINE
1001 PRINT"hm rvs SOLUTIONoff sp sp sp rt rt ";
1002 FORX=0T04:FORY=1T05:T=20
1003 IFX=3THENT=18
1004 E$(X,Y)="lft "+STR$(C(X,Y))
1005 IFC(X,Y)=0ANDX<2ANDY<4THENE$(X,Y)=""
1006 IFC(X,Y)=0ANDX=2ANDY<3THENE$(X,Y)=""
1007 IFC(X,Y)=0ANDX=3ANDY<3THENE$(X,Y)=""
1008 IFC(X,Y)=0ANDX=4ANDY=1THENE$(X,Y)=""
1010 PRNTTAB(T-L(X));E$(X,Y);"sp ";
1020 NEXT:IFX=1ORX=3THENPRINT:PRNTTAB(13);""~e~e~e~e~e~e~e~e~eUp "
1030 PRINT:NEXT:PRINT
1038 PRINT"hm dn dn dn dn dn dn dn dn dn dn dn dn dn dn sp sp sp sp ";
1040 PRINT"*****sp sp sp sp sp sp sp sp sp sp sp sp
sp sp sp sp sp sp sp sp sp sp sp sp sp sp sp "
1041 PRINT"sp sp sp sp sp sp sp sp sp sp YOUsp MISSEdsp ITsp sp sp sp
sp sp sp sp sp "
1042 FORJ=1T04:PRINT"d n ";XX$;;NEXT:PRINT"up up up "
1050 GOT0710
2000 REM INSTRUCTIONS
2010 POKE5946B,14:PRINT"c lr ";TAB(15);"dn dn rvs sp "H"A"N"G"M"A"T"Hsp off dn
dn "
2011 PRINT"sp sp sp sp ~ORIGINALsp ~AUTHORS:sp ~PHILsp ~FELDMANdn lft lft lft
lft lft lft lft lft ~TOTmsp ~RUGG"
2012 PRINT"d n sp sp sp ~APRIL,sp 1977sp sp ~KILOBAUD,sp PG.sp 112
2013 PRINT"d n sp sp sp ~MODIFICATIONssp BY:sp ~J.sp ~R.sp ~ROSSUMsp "
2014 PRINT"sp sp sp sp ~MOREsp CHANGESsp BY:sp sp ~GREGORYsp ~YOBDn lft lft
lft lft lft lft lft lft lft ~PAULsp ~AGOSTAdn "
2020 PRINT"d n dn sp sp sp ~DOsp YOUsp NEEDsp INSTRUCTIONSp ?sp ";GOSUB3000
0
2030 IFA$(>)Y"THENRETURN
2040 PRINT"c lr sp sp sp sp sp sp sp sp sp ~H"A"N"G"M"A'T'H~I"N"S~T'R~U~C~T~I~O~
N~Ssp "
2050 PRINT"d n dn sp sp ~HANGMATMsp WILLsp PRESENTSp YOUs WITHsp A"
2060 PRINT"MULTIPICATIONsp PROBLEMSp WHICHsp HASsp THE
2070 PRINT"DIGITsp REPLACEDsp BYsp LETTERS.
2080 PRINT"d n ~FORsp EXAMPLE:d n "
2090 PRINT"sp sp sp sp sp sp sp Asp Bsp Fsp sp sp sp sp sp sp sp sp sp sp sp
sp Sp 6
2100 PRINT"sp sp sp sp sp sp *sp sp Esp Dsp sp sp sp sp sp sp sp sp sp sp *sp
sp Sp 2
2110 PRINT"sp sp sp sp sp sp ~e~e~e~e~esp sp sp sp sp sp sp sp sp sp ~e~e
~e~e~e~e
2120 PRINT"sp sp sp sp sp sp Hsp Csp Dsp sp sp sp sp sp sp sp sp sp sp sp sp
sp 1sp 2
2130 PRINT"sp sp sp sp sp sp sp sp sp sp sp sp sp sp sp 1sp 3sp 6sp 8
2140 PRINT"sp sp sp sp ~e~e~e~e~e~e~e~esp sp sp sp sp sp sp ~e~e~e~e~e~e~e
~e~e~e~e
2150 PRINT"sp sp sp sp sp sp sp Asp Bsp Hsp Dsp sp sp sp sp sp 1sp 4sp 5sp 9sp 2
2160 PRINT"d n dn sp sp sp ~HEREsp THesP LETTERsp '~A' sp ISsp THesP DIGITsp 4
2170 PRINT"THesP LETTERsp '~H' sp ISsp THesP DIGITsp 9sp ANDsp SOsp ON." :GOSUB3
100
2200 PRINT"c lr dn dn sp sp sp sp -~I"N~S~T~R~U~C~T~I~O~N~S~ ~C~O~N~T~I~N
~U~E~D~-
2210 PRINT"d n dn sp sp ~TOsp ENTERsp Asp GUess,sp JUSTsp TYPEsp THE"
2220 PRINT"LETTERsp ANDsp NUMBER.sp sp ~FORsp EXAmPLE.sp '~A'"
```



```

2230 PRINT"ANDsp '4~A' sp WILLsp BOTHsp WORKsp FORsp MATCHING"
2240 PRINT"THEsp LETTERsp '~A' sp WITHsp THEsp DIGITsp '4'."
2250 PRINT"dn sp sp ~YOUsp WILLsp BEsp GIVENsp 12sp CHANCEsp TOsp SOLVE
2260 PRINT"THEsp PUZZLEsp BEFOREsp THEsp SOLUTIONsp ISsp sp sp sp sp sp sp DIS
PLAYED."
2270 PRINT"dn sp sp ~IFsp YOUsp PRESSsp 'Q',sp THEsp SOLUTIONsp WILLsp sp sp B
Esp GIVEN.":GOSUB3100:RETURN
3000 REM * INPUT CHARACTER *
3010 PRINT"rus ~?ift ";;FORJ=1TO350:NEXT
3020 PRINT"off ~?ift ";;FORJ=1TO350:NEXT
3030 GETA$:IFA$=""THEN3010
3040 RETURN
3100 PRINT"dn dn sp sp sp sp sp sp PRESSsp rus SPACEsp BARoff sp TOsp CONTINUE
sp ";
3110 GOSUB3000:RETURN
3200 REM GUESS ENTRY
3215 PRINT$
3220 F=0:Z$=""@:N=-1
3230 PRINT"YOURsp GUESS:sp sp sp lft lft ";
3240 FORK=1TO2
3250 GOSUB3000:IFA$=CHR$(13)ORAS=CHR$(17)ORAS=CHR$(19)ORAS=CHR$(29)THEN3250
3255 PRINTA$;
3260 IFA$="Q"THEN F=1:RETURN
3270 REM FORM Z$,N
3280 IFA$>@THENZ$=A$:GOTO3300
3290 N=ASC(A$)-48
3300 NEXTK
3310 REM CHECK VALIDITY
3320 IFN<0ORN>9THEN3350
3330 IFZ$<"A"ORZ$>"J"THEN3350
3340 PRINT:RETURN
3350 PRINT:PRINT"up BADsp NUMBERsp ORsp LETTER"
3360 FORJ=1TO800:NEXT
3370 PRINTXX$
3380 PRINT"up ";;GOTO3220
3500 REM TEMP MESSAGE DISPLAY
3520 PRINT$;"dn dn dn ";;M$
3530 FORJ=1TOT*1000:NEXT
3540 PRINTXX$
3550 PRINT"dn dn "
3560 RETURN

```



"And just how big is this new computer?"

```

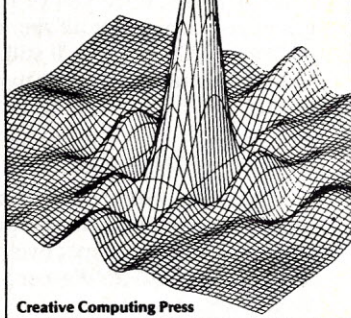
5000 REM MISS SUBROUTINE
5001 IFW<>12THEN5005
5002 PRINT$;
5003 FORJ=1TO3:PRINTP$(13);"dn ";;PRINTP$(12);:FORK=1TO25:NEXTK
5004 NEXT:T=5:M$=HMS(W):GOTO5005
5005 PRINT$;P$(W):T=3
5006 IFW=0THENRETURN
5010 M$="**sp WRONGsp **sp sp DRAWsp THEsp "+HMS(W)
5050 GOSUB3500:RETURN

```

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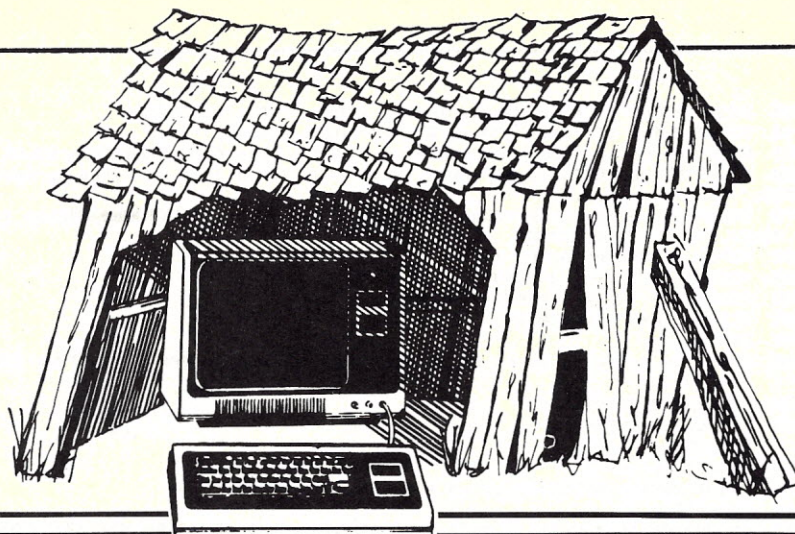
Edited by David Ahl. Large format paperbound, 224 pages, \$15.95. (12D)

To order use handy order form in the back of the magazine.



# TRS~SO Strings

Stephen B. Gray

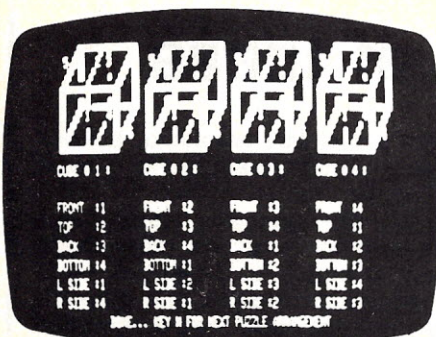


For column number 26, let's take another look at string packing with some comments by top programmer Leo Christopherson, two programs for renumbering program lines, a software directory, Radio Shack's Astrology program, five moves that will beat Microchess, and the tale of a vanishing van.

## String Packing Revisited

In the Dec. 1980 column, we discussed how to create screen graphics using string packing, which was discovered by Leo Christopherson. String packing may have been simultaneously discovered by several other program writers, who will undoubtedly be heard from.

Back when I first checked out Leo's Cubes program (Aug. 1980, p 162), which is the computer version of Parker Brothers' Instant Insanity game that uses four colored plastic cubes, I asked Leo how he created the four cubes on the screen.



His letter was the basis for most of the explanation of string packing in that December column. Because that letter explains how he discovered the principle, here's most of it:

"Back when I was finishing Android Nim with sound, and Snake Eggs, I noticed that strings that were defined in the Basic text (such as 20 A\$="1234") were not stored in high memory. But when one builds a string (such as 20 A\$="1"+"2"+"3"+"4" or 20 A\$=CHR\$(49)+CHR\$(50)+CHR\$(51)+CHR\$(52)), then the actual string of "1234" is way up in high memory. It, in

effect, exists twice, once in line 20 as an operation and then also in high memory as "1234".

"It occurred to me that since I was then building up strings to print graphics rather than using the SET command (such as 1000 B1\$=CHR\$(128)+CHR\$(128)+CHR\$(128)+CHR\$(160)+CHR\$(188)+CHR\$(140)+CHR\$(140)+CHR\$(140)+CHR\$(156)+CHR\$(172)+CHR\$(140)+CHR\$(140)+CHR\$(140)+CHR\$(172)+CHR\$(188), which is the top line of the cube in Cubes), if I could put those numbers (128, 128, 128, 160, 188, and so on) in a string located in the Basic text, this would save room and the string would not have to be constructed in high memory each time the program was run.

"Well, it turns out that the VARPTR command will find the start of a string anywhere in memory. So I entered a string in this form: 1000 B1\$="....." (15 periods).

"Then I used VARPTR to find the start of B1\$: N = PEEK (VARPTR (B1\$) + 2) \* 256 + PEEK (VARPTR (B1\$) + 1).

"Then I set up a data line as follows: DATA 128, 128, 160, 188, etc.

"This was followed by a FOR-NEXT loop: RESTORE: FOR X = 0 TO 14: read D: POKE N + X, D: NEXT X: STOP.

"Now, after running this, the string looks like it does when you list line 1000 of Cubes, (B1\$="ENDENDENDOUT... and so on).

"So you see, the graphics are being printed on the screen as a string, not with set commands. Those token words occur since Microsoft Basic uses the numbers 128 to 255 as tokens for their commands when listing programs. I suppose they never intended for strings with bytes of higher than ASCII numbers in them to appear in the Basic text. But it works! The CHR\$(128) or a blank, appears as END in a listing. So, from my point of view, the appearance of those token words is of no concern to the purpose of string packing.

"So, to review, to use this technique in a program, you first have to plan out your graphics games as a series of lines of graphic CHR\$( ) numbers. Then set up a

'dummy' line of periods (or some other ASCII character) to serve as the place to transfer the graphic bytes to. The VARPTR then finds where the string of periods is and the DATA and FOR-NEXT loop packs the string.

"I've used this technique to pack strings with machine-level subroutines, which works well, too."

If you'd like to try Leo's method, to create the top line of the first cube, try this, which is similar to the string-packing program in the Dec. 1980 column, with some slight changes to slim it down for this column width:

```
100 CLS
1000 B1$="....."
1050 L=PEEK(VARPTR(B1$)+2)*256
1060 R=PEEK(VARPTR(B1$)+1)
1070 N=L+R
1100 DATA 128,128,128,160,188
1110 DATA 140,140,140,156,172
1120 DATA 140,140,140,172,188
1160 FOR X=0 TO 14
1170 READ D
1180 POKE N+X,D
1190 NEXT X
1200 PRINT B1$
1300 GOTO 1300
```

Incidentally, once you've run this program, you can delete all the lines except 1000 and 1200, and you'll still get the top line of the cube if you run just those two lines.

## A Misunderstanding

In my review of Leo's Cubes and Snake Eggs programs (which are published at \$9.95 and \$14.95, respectively, by 80-US Software, 3838 South Warner St., Tacoma, WA 98409), I wrote:

"... there's just so much graphics can do for a game. Two of Leo's recent games, Cubes and Snake Eggs, are games in point. Both are beautifully programmed, with very clever graphics, yet even the most devoted of games players would probably be interested in no more than a few games. After all, marzipan is used to create some beautiful candies, but how much marzipan can you eat?"

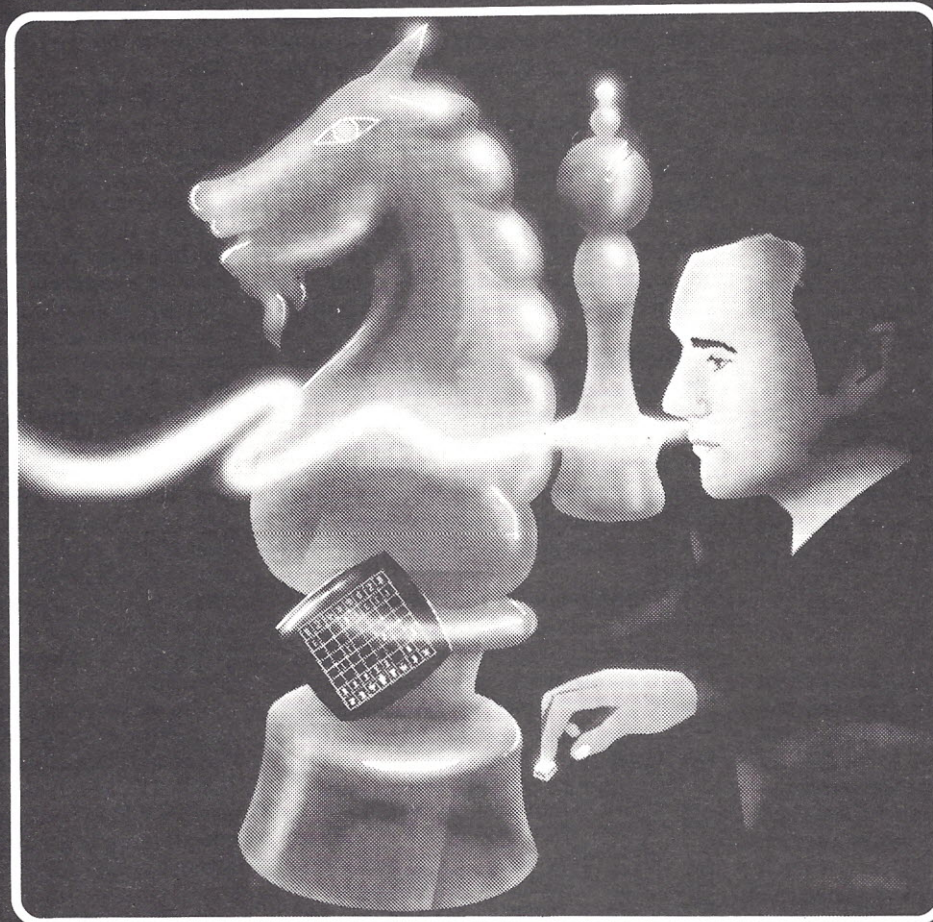
I'd like to share Leo's response with you:

"One of the most rewarding things I've



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## TRS-80, continued...

found to do is to program animated graphics games which others like to use for the pleasure they get from them. Most of my programs involve rather trivial games, partly because the game itself interests me less than the graphics, and partly because there is so little memory left in a 16K TRS-80 after the graphics have been set up.

"I tend to look at my programs as little artistic creations which are to be enjoyed for a while and then set aside for a while until the desire to experience them again arises. Much as a person would listen to a special record of music only when the urge comes to do so. But that urge doesn't necessarily occur too often. Your 'marzipan' describes this pretty well.

"Now, I'll have to clear up a misunderstanding. Cubes isn't really a game at all. The ads for it and the instructions with it must be misleading. I wrote Cubes to solve the Instant Insanity puzzle. It is a very special-purpose program! You are supposed to have the real blocks in front of you and you use the computer to find the correct re-orientation for a solution. One could use the program to design a new coding blocks, too, I suppose.

"I wrote that program after spending some hours solving the real puzzle and then forgetting how I did it. The puzzle comes with an offer to send a person the solution if he or she writes to the company for it. I designed Cubes as an alternate method for people to get solution to all such block puzzles."

## RNMBR

After you've written a program in which you had to insert lines here and there, you may want to renumber some or all of the lines. Perhaps you want to make the program easier to read, or maybe you prefer evenly spaced line numbers, or you need to insert more lines and there's no place to put them.

You could rewrite the whole program, which might take hours, or you can use a Basic renumbering program, which could take only minutes.

RNMBR is offered by Microbiotic Computing Inc. (1124 Bernalillo Place S.E., Albuquerque, NM 87123) for \$20. You order a cassette depending upon your Level II TRS-80 configuration: 4K, 16K without DOS, 32K or 48K with DOS.

The short but complete 14-page manual explains the simple RNMBR method for renumbering. You add one or two of three different types of REM statements to the ends of the lines (or to the first of the group of lines) you want to change.

If you want the renumbering to start with line number 150, just add REM//B=150 at the end of the first line to be renumbered. The default line number, which the program will start with if you don't specify one, is 100.

To create an increment of 7, simply add REM//I=7 where needed. You can put it on the same line as the B command.

If a line number is not to be changed, add REM//S, which means the number stays the same.

RNMBR changes line-number references as necessary in statements such as GOTO, GOSUB, ON/GOTO, IF/THEN/ELSE, etc. It is written in machine language and loads at the top of your memory, which is why you have to specify your memory size. RNMBR is written twice, once on each side of the cassette.

The RNMBR commands can be left in your program, since they're all in REM statements. You might leave them in while developing a program, and remove them when finished.

RNMBR also includes diagnostics in case you make a renumbering error: three fatal-error diagnostics and two informative diagnostics.

The first informative diagnostic flags GOTOs and GOSUBs that aren't followed by a statement number. The other will flag references to line numbers that don't exist.

The first fatal condition occurs if two lines are given the same line number in the renumbered program. The second occurs when a line number or increment goes beyond 65535. The third occurs when a command format error is detected; this is when // is detected and the program does not find an expected valid RNMBR command.

If RNMBR detects a fatal condition, the original Basic program is restored to memory and control is returned to Basic. Without this restoration feature, you could lose one or more lines from your program.

As an example of using RNMBR, take this simple program which is

```
1 REM//B=10 A RENUMBERING EXAMPLE
10 INPUT "RADIUS OF SPHERE";R
14 IF R<0 THEN 10 ELSE IF R>100
   THEN 200
100 V=4/3*3.14159*R*R*R:REM//S
110 PRINT "VOLUME OF SPHERE";V
125 A=4*3.14159*R*R:REM//B=50//I=1
130 PRINT "AREA OF SPHERE";A
175 GOTO 10:REM//B=150
200 END
```

to have the first three lines renumbered from 1-10-14 to 10-20-30. Since no increment is specified, RNMBR uses the default increment of 10. Line 100 stays with the same number, as will 110. But 125 is changed to 50, and line 130 to 51, because an increment of 1 is specified. Line 175 is changed to 150, and because the increment hasn't been changed, line 200 becomes 151.

```
10 REM//B=10 A RENUMBERING EXAMPLE
20 INPUT "RADIUS OF SPHERE";R
30 IF R<0 THEN 20 ELSE IF R>100
   THEN 151
50 A=4*3.14159*R*R:REM//B=50//I=1
51 PRINT "AREA OF SPHERE";A
100 V=4/3*3.14159*R*R*R:REM//S
110 PRINT "VOLUME OF SPHERE";V
150 GOTO 20:REM//B=150
151 END
```

Note that RNMBR automatically changes all line-number references, and moves new lines 50 and 51 to new positions in the program.

## RENUM

How does RNMBR compare with Radio Shack's RENUM line-renumbering program, which costs \$9.95?

The old TRS-80 catalog said RENUM is for 4K only, and the new one says it's for 16K only. Both are wrong. The package consists of two cassettes, with four RENUM programs (each written twice), for 4K, 16K, 32K and 48K systems. A line-renumbering program is included in Disk Basic.

To call RENUM, you enter SYSTEM, and then a slash followed by the entry-point; for a 16K Level II system, this is /31820. You use this calling sequence every time you want to renumber.

When you call RENUM, the program displays three prompts, and all you do is enter the parameters, one after each prompt. The first is OL#= for the old line, then NL#= for the new line, and INC= for the increment. Default values for the three are 1, 10 and 10, respectively. So if you don't enter a number after OL#=, the entire program will be renumbered.

RENUM has two error messages. The first indicates an illegal function call, if you try to create line numbers greater than 65529, enter an INC of zero, use a value of OL# greater than the largest line number in your program, or try to change the sequence of the program lines. Note that you *can* change the sequence with RNMBR.

The other error message occurs when your original program references a line that doesn't exist, such as GOTO 100 when no line 100 exists in the original program.

RENUM also changes the line-number references in your program, for references in lines with GOTO, GOSUB, THEN, ELSE, etc.

So RENUM costs half as much as RNMBR, but does only half as much. With RENUM, you can't change the sequence of lines, or change only one line number (unless it's the last line in the program).

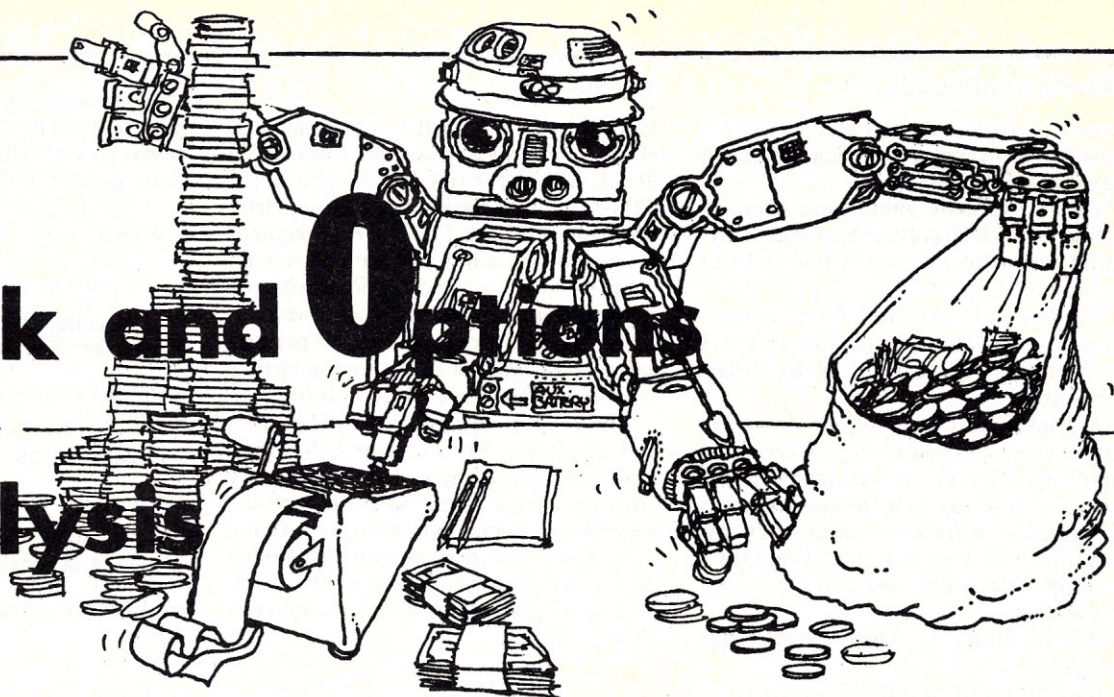
Using RENUM, you could renumber most of the lines in the sample program that RNMBR does a complete job on. But you'd have to first change line 1 to 10, with an increment of 10. Then change new line 40 to 50 with an increment of 1. Then change new line 52 to 100, with an increment of 10. Then change new line 120 to 150, with an increment of 1. But there's no way in RENUM to move those two area lines further up in the program, as RNMBR does.

## 80 Software Directory

80 Software Directory is the new name of what previously was TRS-80 Software



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**Newprem** enables the user to predict the future premiums of an option at whatever time and future stock price the user selects. This method requires the establishment of a data base of historical option premiums in whatever detail the user desires.

Finally, **Portval** enables the user to determine on an item by item basis, the cost, current value per share, total current value and capital gain of a portfolio consisting of long and short stock, and long and short option positions. This program assists the user in keeping a readily available and easily updatable record of his portfolio and, at the same time, assists him in measuring his progress towards financial success.

In order for an investor to continually improve his performance it is necessary for him to refer to past performance; this requires useful records. Finally, he should constantly be evaluating his performances to assure himself he is playing the right game.

The **Stock and Options Trading Analysis** package is available for the 16K TRS-80 Level II on cassette (CS-3306) and disk (CS-3801) for \$99.95. Creative Computing Software should be available at your local computer store. If your favorite retailer does not stock the software you need, have him call our retail marketing department at the number below. Or you can order directly from Creative Computing Software, Dept AGII; P.O. Box 789-M, Morristown, NJ 07960. Visa, MasterCard, or American Express are also welcome. For faster service, call in your bank card order toll free to 800-631-8112. In NJ call 201-540-0445.

## TRS-80 Professional Software

**Creative  
Computing  
Software**



Source (*Creative*, April 1980, p 134). It's published by Computermat (Box 1664, Lake Havasu, AZ 86403).

The undated (summer?) fifth edition is \$6 and contains 7,500 listings and 614 suppliers. The price went up to \$8 last September.

Dave's advice is "Don't waste your money."

In 1979 the publisher intended to include "software reviews," but so far these haven't materialized.

The directory may be of interest to someone who buys a lot of TRS-80 software, and who realizes the directory is incomplete.

After you've loaded the machine-language Astrology program from Radio Shack (\$29.95 for 16K Level-I or Level-II TRS-80), it asks for your full name, birth-date, time of birth (AM or PM, daylight savings time?), where you were born (city, state, latitude, longitude), and whether or not you want your horoscope printed.

The 36-page manual includes latitudes and longitudes for 50 major U.S. cities. You can approximate these "using any atlas or a large map," says the manual, which also recommends buying two books, *Longitudes and Latitudes in the United States and Time Changes in the USA*, "if you are going to be doing a number of charts."

natal aspects, such as

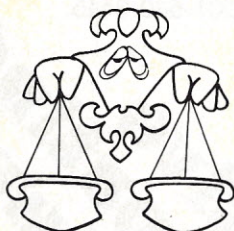
elements and modes: planets in the houses, such as

JUPITER IS IN THE 4TH HOUSE

signs on the cusps of the houses, such as

THE CUSP OF THE 1ST HOUSE IS  
25.9 DEGREES IN VIRGO

and for the grand finale, *The Zodiac At Birth*:

[illegible]



If you don't have a printer, the program gives the same material except for The Zodiac At Birth, in seven displays. (The Zodiac At Birth is a Natal Chart, which encompasses most of the data in the displays, but is too large for the screen.)

The manual has 19 pages on Reading the Horoscope, with sections on Influence of the Planets; Natal Aspects; Signs of the Zodiac; Placing the Planets in the Signs; Blending the Sun, Ascendant and Moon in the Signs; The Houses; and Secondary Progressions.

The manual ends with a list of eight books for Recommended Further Reading.

The most fascinating part of the package is the large (35 by 23 inches), elaborate and colorful poster, which has a dozen charts that help interpret the horoscope. Three are of major interest.

According to the "Planets in Signs" section of the poster, I am a detail analyzer, have a need for harmony with others, pay attention to detail, lack cohesion, etc.

According to the "Planets in the House" section, I have these characteristics: optimistic, flexibility, communicator; family loyalty; expresses well, talker, witty; restless, belief in own ideas, etc.

According to the "Signs on the Cusps of the Houses" section of the poster, I am (or have) sensitive, intuitive awareness; ambitious for luxury; dramatic travel; perfection in home, conversation; passionate, jealous, demanding; need excitement, etc.

Most of the characteristics on the three main charts are flattering, with a few pejorative ones thrown in for balance, as is usual with horoscopes.

The Astrology program is played absolutely straight by Radio Shack. That is, the manual is written from the attitude of a true believer, to the point of saying that if you take an "Aries Ascendant person" and put him together with a "Taurus Sun practical, stable car" ("think of the Sun in a sign as the type of car the person drives"), "he'll drive that car at top speed, recklessly."

The Astrology program is listed, appropriately, in the Radio Shack catalog under "Games," along with Flying Saucer, Pyramid, and SpaceWarp.

### Beating Microchess

If you're getting highly frustrated from not being able to beat Microchess even at the IQ 1 level, you may be interested in a note sent by Ted Fisher of Danville, Illinois. He "just wanted to report a piece of top-secret information," a program to beat Peter Jennings' Microchess 1.5 in five moves:

E2-E4  
D1-F3  
F1-C4  
C4-D5  
F3-F7

Microchess makes the same moves at all three levels of play, taking more and

more THINKING time to do so if you move up from IQ 1 to IQ 2 to IQ 3, and finally comes up with

### CHECKMATE YOU WIN!

Peter Jennings says several people have sent him programs such as this one, and comments that it's similar to the Fool's Mate; "Microchess falls for it." However, Microchess 2.0, the version used in the PET and Apple II computers, "doesn't fall for it," he said.

As for an improved version of Microchess for the TRS-80 from Personal Software Inc., Jennings says there won't be one in the immediate future, but adds, "I suspect we will be forced into developing it by popular demand. We get so many letters asking 'When are you going to send us the improved version?' They just want to see general improvements, nothing much specific. Any improvements at all will mean going beyond the 4K that Microchess is written in now. The next logical step up, for the TRS-80, is to a 16K Microchess."

Microchess is available at \$19.95 in many Radio Shack stores no, and was reviewed in this column in the Feb. 1979 *Creative* (page 102).

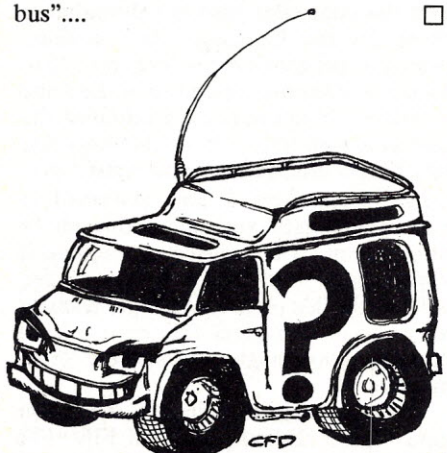
### Robot Van Vanishes

If you got excited over the robot van operated by radio-frequency signals controlled by a TRS-80, mentioned in the new-products column in the Feb. 1980 *Creative* (p 173), you can relax now.

According to 3G Company, producers of a \$34.95 light pen (March 1980, p 154), they weren't able to get a small number (several hundred) of the vans from a Hong Kong manufacturer, for trying out the market, and they didn't want to take the risk of buying the very large number of vans he required as a minimum order.

The idea was good, and perhaps somebody else will try it out. The \$85 3G van, 10 inches long, would have used a command unit plugged into the TRS-80's output port, "operating the van through radio controls," using "simple Basic statements to control forward, reverse, right, left, start, and stop."

It could have been called the "TRS-80 bus"....



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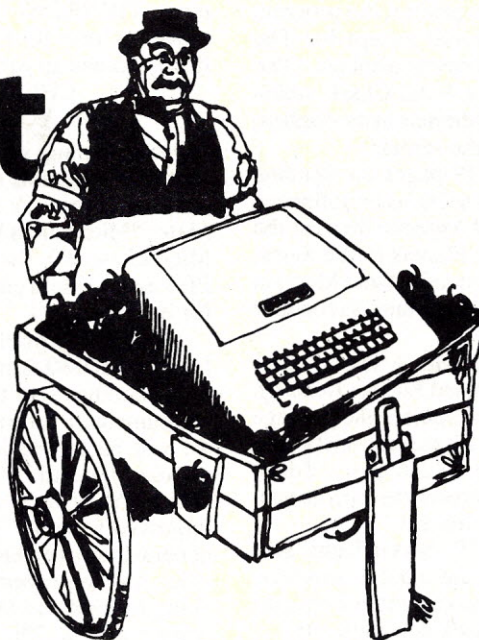
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# Apple~Cart

**Chuck Carpenter**

Correspondence is always welcome and a response will be made to those accompanied by a SASE. Send your letters to: Chuck Carpenter, 2228 Montclair Pl., Carrollton, TX 75006.



Well, here we are in another year. Lots of things have happened in the Apple world. And, I expect a lot more will happen. There are a dozen or so companies making accessories and many more writing software. I mentioned a directory of Apple products in last month's column. This same company publishes a directory of Apple software. And, I have seen at least one other company offering a directory of Apple software. The magazine is called *Peelings II* and is dedicated to reviewing software for the Apple. Like any review, the contents are biased by the preference and interests of the reviewers. They claim to be impartial but we are, after all, human creatures. Even so, the magazine is a valuable source of information about the software and its general worth. *Peelings II*, at \$15.00 for 6 issues, is available from Peelings II, 945 Brook Circle, Las Cruces, NM 88001; Phone (505) 523-5088 evenings. At this time (Sep. '80), the copy I have is Vol 1 No. 2. If you're interested, you may want to get all the back issues too.

## DOS 3.3

This new Disk Operating System (DOS) from Apple converts your 13 sector system to a 16 sector system. You can still use your 13 sector disks as-is but the process is more awkward. You can't boot directly from 13 sector disks so you have to go through a 2 step process each time.

Included with the DOS 3.3 package are the following:

- Two new ROMs for the controller card
- A ROM puller tool
- The DOS Manual
- A 16 sector Master System diskette
- A Basics diskette

The ROMs are installed in place of 2 that

come with the disk drive controller card. The programs in these ROMs allow the system to "read" the 16 sector diskettes. After you install them, you can no longer use 13 sector diskettes to boot the system. To use 13 sector disks, first boot the system with the Basics diskette. Then insert the 13 sector diskette and run. As long as no problems occur you can change from one diskette to another. If you're using the protected type diskettes (not copyable) you have to start over from the beginning to change to another diskette. Same thing if a loss of 13 sector DOS occurs. The 16 sector Basics disk has to be booted first, then run the 13 sector disk.

All is not lost though. Included on the 16 sector Master System diskette are programs to convert (move programs from) 13 sector disks to 16 sector disks. Since you gain about 23K more storage space on a diskette, there is some advantage. Also, the 16 sector system is compatible with the language card system and the new Softcard CP/M and MBasic system from Microsoft. (The ROMs used to convert the controller card are the same as those for the Language Card system.) Once you programs are moved from 13 to 16 sector diskettes, operation is the same as always. You could even initialize the diskettes with new volume numbers and HELLO programs before you transfer programs. (Dave Powell, now stationed in Germany, might appreciate this bit of information.) The transfer of programs is made easy with a program called MUFFIN. This program lets you transfer all types of individual files or complete catalogs with single or multiple drive systems.

Another program included on the System Master diskette is called FID (File

Developer). This program has two functions. First, it lets you easily catalog, copy, delete, lock and unlock all types of DOS files. Second, it lets you copy from one diskette to another with only one disk drive. This program extends the capabilities of the system allowing you to more easily work with files and the DOS.

The DOS manual is a revised and expanded version of the original DOS 3.2 manual. Most of the information is the same. There are new sections covering operation using 16 sector diskettes. A section on Format of Diskettes Information is expanded as is the section on Using Machine Language Files, especially the RWTS (Read or Write a Track or Sector) subroutine. Other sections fully describe the features and use of the FID and MUFFIN programs.

I heard rumblings at one of our Apple Corps meetings that DOS 3.3 would work only on 48K systems. I can't tell you otherwise, since mine is 48K. Check it out first. You can get DOS 3.3 for about \$60.00 from your Apple supplier.

## Reader Input

Randy Reeves from Cypress, TX sends along a tip for relief of programmers eyes. He has found that the plastic material sold in auto stores for reducing glare in your car, works well for cutting down glare from the monitor. The effect can also be achieved by using the sun screen material sold at hardware stores. Randy is also recommending the Program Line Editor from Synergistic Software. This program is also available from *Call A.P.P.L.E.* if you are a member. The editor is being used by several of our club members and is claimed to cut down programming time. I have it but have not



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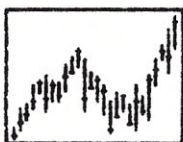


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## Apple, continued...

used it enough to make any knowledgeable comment.

In the August '80 column, I commented on the declining quality of disk drives being shipped by Apple. Apparently others have experienced problems similar to mine. From Otterbein College in Westerville, Ohio, David Deeve sent along his techniques for dealing with the problem. He writes, "I've found it works well to insert the disk, close the door, reopen the door and close it again." (This centers the diskette on the clamp...C.C.) And he continues, "Also, when first initializing or copying a disk I always remove it, reinsert it and try a CATALOG to assure me that the disk was properly written." David also included what he finds to be an undocumented Pascal item. "If you have a codefile named SYSTEM.STARTUP (not SYSTEM.STARTUP.CODE) it will run automatically when the disk is booted. That is, a turnkey or "HELLO" type program."

### An Applesoft Bug

A letter from Joe Verzulli from Port Jefferson Station, NY, turned up an interesting little Applesoft Quirk. The problem has to do with the use of string variables when DOS is not in use. It was an interesting coincidence that the July/August issue of *Call A.P.P.L.E.* included a short piece describing the same problem. Joe's example program looks like this:

```
10 GET R$
20 T = VAL(R$)
30 PRINT T
```

If you type in a number less than 9 for the GET, you will see the number printed to the 16th power. If you add:

```
15 R$ = R$
```

The problem seems to go away. I got as far as determining that a second variable was added to string variable table. You can do this by examining the area of memory where string variables are stored. In Applesoft, this is from HIMEM down. As you will recall, without DOS, HIMEM is at 49152 or \$BFFF (HEX). I puzzled over the reasons for a while and called for help. I called Bob Sander-Cederlof at S-C Software and described the problem. He had just seen the *Call A.P.P.L.E.* item too. After discussing it for a few minutes, I had a better understanding and sent along a reply to Joe. A couple of days later I received a more detailed analysis from Bob to include in the column.

### The Details

If you have a 48k Apple, and start up Applesoft without DOS, the program in-

cluded by Joe and similar ones by others will produce strange results. If the number 1 is entered, the value printed is 1,1111111E16. For 2 you will get 2.2222222E16 and for 9 it becomes 1E17. Continuing essentially as Bob wrote it, this is what happens.

"The VAL function in Applesoft has a bug. I looked into the code (from \$E707 through \$E745 in the ROMs), and here is what it does. It finds the string, and sets the address of the first byte of the string into \$5E and \$5F. (Remember that \$ means a hexadecimal number...C.C.) Then it adds the length, and stores the address of the byte following the string in \$60 and \$61. The value stored in that byte is saved on the stack, and a zero put in its place. Then the FIN subroutine is called, to convert the string to a floating point value. After the conversion is finished, the original contents of that byte are restored from the stack.

"The problem is this. In our little program, GET(R\$) creates the R\$ string at location \$BFFF. The byte following is \$C000, but there is no memory there. In fact, \$C000 is the input register from the Apple keyboard! When VAL tries to store a zero at \$C000, nothing happens. The FIN subroutine reads the digit you typed once at \$BFFF, and then 16 more times at \$C000, \$C001, ..., \$COOF. That is a total of 17 digits, like this: "1111111111111111". The value of such a string is truly 1,1111111E16, just like the Apple said. If you type a 9, the value is rounded up to 1E17.

"Inserting the statement R\$=R\$ causes Applesoft to create another copy of the string at \$BFFE, which is a safe location. Safe, because the zero VAL inserts will go at \$BFFF, which is a real memory location.

"Another way to avoid this problem is to use HIMEM:49151 instead of the normal 49152 that is automatically set up. Still another way is to be certain that R\$ is not the first use of a string. But my preferred "fix" is to buy a disk drive or two and use DOS. When DOS is loaded (in a 48K machine), HIMEM is at \$9600, and everything works fine!"

Bob and I also discussed what would happen in a machine with less than 48K. Our guess is that it will be garbage since there is nothing there. Or, it just might seem to work ok. If you have a less-than-48K machine, try it out. My thanks to Bob for sharing this in-depth analysis.

### Micro-Verter

If you haven't bought a modulator for your Apple, try this one. The Micro-Verter by ATV Research is battery operated and requires only one connection to the video output connector on the Apple. No connection is required to the

TV since the signal is radiated by a short antenna stub on the Micro-Verter. The modulator is designed to work in the UHF channel range. After I installed the batteries, I experimented with the tuning range. I found that it would tune from channel 14 to 21. The unit seemed to operate the best on channel 17. There was practically zero distortion and very clear color on this channel. My guess is that I was in the center of the tuning range. This would be likely to give the best balance of bandwidth and other desirable characteristics. Speaking of distortion, this unit provides the cleanest signal of all the modulators I have tried. Since you do not have to connect the unit to the TV set, the worms from computer switching harmonics are practically nonexistent. Another feature I found useful also relates to the freedom from connections. If you wanted to use several monitors for demonstration purposes, you can use the Micro-Verter with a 6in hairpin antenna connected to the stub. This way the signal can be used by several sets within a 10 foot or so radius of the modulator. Very handy in a classroom environment. I used it this way when I taught an assembly language class.

The unit is packaged in a metal box and includes all connectors, cables, and a battery holder inside. There is a power switch on the front. Even though the unit will last several months with the switch left on, the switch provides extended battery life. The batteries are not included with the modulator. One note of caution. Use a plastic screw driver to tune the unit to the desired operating channel. This is not mentioned in the instructions. A metal screw driver could distort the tuning and is likely to short the metal case. The Micro-Verter is \$35.00 postpaid in the U.S. and Canada, from ATV Research, 13N. Broadway, Dakota City, Nebraska 68731; phone (402) 987-3771.

### From Here And There

As a result of collecting Apple information from all over, I have accumulated several clever and useful programming ideas. The first one is shown in listing 1. This is the control program from South-eastern Software's *Magazine Article File Program*. The program sets-up a menu of options. Then, you can use the escape key (ESC) to move the cursor over the selections. Several ASCII values are used in the program. You will see these in the CHR\$ functions. These are:

- CHR\$(4) (CTRL) D
- CHR\$(13) (RETURN)
- CHR\$(27) (ESC)
- CHR\$(91) left bracket

You can find all the ASCII codes on pages 138 and 139 in the Applesoft reference manual.

Each of the menu options are posi-



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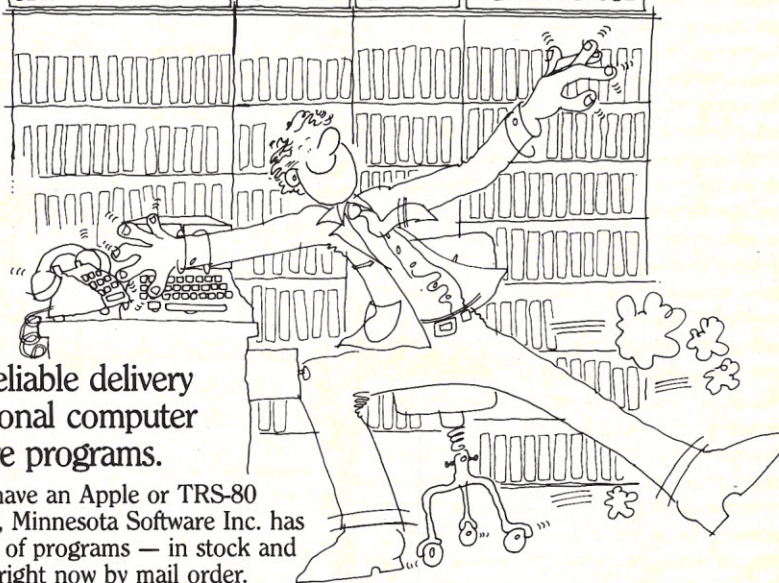
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## Apple, continued...

```

0 D$ = CHR$ (13) + CHR$ (4)
20 HOME
30 PRINT D$;"NOMON C,I,O"
40 VTAB 2: HTAB 9: PRINT "SOUTHE
  ASTERN SOFTWARE"
42 HTAB 7: PRINT "MAGAZINE ARTIC
  LE PROGRAM"
50 PRINT "-----"
60 VTAB 8: PRINT " USE THE "; CHR$
  (91);"ESCJ KEY TO MOVE THE C
  URSOR"
70 PRINT "TO YOUR SELECTION AND
  THEN TYPE 'RETURN'"
80 VTAB 12
90 PRINT " CREATE/ADD FILE"
100 PRINT " SEARCH FILE"
110 PRINT " CORRECT FILE"
120 PRINT " LIST CONTENTS OF EN
  TIRE FILE"
130 PRINT " TRANSFER FILE AND P
  OINTERS"
140 PRINT " END PROGRAM"
200 SE = 1:VT = 12
210 VTAB VT: GET SE$
220 IF SE$ = CHR$ (13) THEN VTAB
  20: GOTO 260
230 IF SE$ = CHR$ (27) THEN VT =
  VT + 1:SE = SE + 1
240 IF SE = 7 THEN 200
250 GOTO 210
260 PRINT : VTAB VT: FLASH : PRINT
  "X": NORMAL
265 ON SE GOTO 300,310,320,330,3
  40,350
300 PRINT D$;"RUN CR MAG FILE"
310 PRINT D$;"RUN MAG FILE SRCH"
320 PRINT D$;"RUN CRRT MAG FILE"
330 PRINT D$;"RUN MAG FILE DUMP"
340 PRINT D$;"RUN MAG FILE EXCH"
350 VTAB 23: END
65535 REM

```

Listing 1

tioned on the screen in lines 80 to 140. Lines 200 to 250 move the cursor from selection to selection when the (ESC) key is pressed. The GET command is used to check for the (RETURN) key. When it is pressed, the program branches to line 260 where a flashing asterisk is put next to your selection. Then depending on the selection number, a program is loaded and run. This is also a good way to conserve memory. If all the menu options were too large to fit in memory at once, this technique overlays memory with the current operating program. At the end of the current option, you would run the menu program again.

Here's another one from the South-eastern Software *Newsletter*. In the August '80 issue I included an Integer Basic program called 'puff'. This program would scroll a message across the screen billboard style. For those of you without Integer Basic, here's one in Applesoft. It was written by Dr. Romano and it appeared in *Newsletter* number 7. See Listing 2.

This program, also a billboard scrolling program, is from *The Apple Gram* (Dallas). It's called *Moving Title Demonstration* and was written by Bob Sander-Cederlof. See Listing 3.

This program is a little less obvious so I'll include the description that goes

alongwith it. First, the program clears the screen, sets text mode and sets the variable 'Q' equal to the address of the Apple's speaker. Next in line 30, two rows of stars are printed. These are for the title to pass through. In line 80 the title content is defined and made equal to the length of the row of stars; 34 in this example. Moving the title is accomplished in line 90. The title is centered by the limits of the FOR loop, and sound is created by the PEEK(Q) function. Line 95 is a delay loop giving the user time to read the display. In line 110, the program is listed so you don't have to do it.

Another one from *The Apple Gram* and also by Bob, helps you ask questions in the program. Here's how it goes... Many times when you want to ask the user of a program a question, they must answer either "yes" or "no". I must have written a thousand different versions of this kind of question routine. Sometimes I code them in line, and sometimes I am smart enough to write a general subroutine to do it.

```

LIST
1 HOME
3 VTAB 12
5 INPUT "..... THE BILLBOARD
  SHALL READ ..... ? ";A$
6 A$ = "
      " + A$: REM *
      ** THE SPACE BETWEEN THE QUO
      TATION MARKS IS 40 SPACES
10 HOME
20 L = LEN (A$)
30 FOR X = 1 TO L
40 S = L - X
50 VTAB 12
60 PRINT MID$ (A$,X,40);
70 IF S < 40 THEN PRINT MID$ (
  A$,1,39 - S)
80 FOR T = 1 TO 150: NEXT T
90 NEXT X: GOTO 30
J

```

Listing 2

Finally, I hit upon a really neat subroutine for answering this kind of question while I was working on a text editor. Here is the code:

```

100 PRINT Q$;"(Y/N)"; GET A$;
      IF A$="Y THEN YES=1:RETURN
110 IF A$="N THEN YES=0:RETURN
120 INVERSE:PRINT"PRESS 'Y' OR 'N'...";
      NORMAL:GOTO 100

```

To use the subroutine, you put the question, without a question mark at the end, into string Q\$; then you call the subroutine with a GOSUB. When the subroutine returns, you test the value of the boolean variable YES and take appropriate action. The subroutine handles making sure the user does type either a 'Y' or an 'N', and will not return until this is done. It tells them what to do, and keeps on asking the question until they do it. Here is an example of a calling line:

```

1910 Q$="DO YOU WANT TO SEE THE CATALOG";
      GOSUB 100: IF YES THEN PRINT D$;"CATALOG"

```

Notice that the IF statement tests the boolean value of YES, by just "IF YES

THEN...". This is because the IF processor in Applesoft (as in Integer Basic) will take the true branch if the value of the expression is non-zero, and the false branch if it is zero.

## Microsoft Z80 Softcard

Well, I have the Softcard in my machine now, and so far, I am pleased with it. I have found one problem that I believe to be a bug. You can't open a random file directly from the program. In order to use a random file, it was necessary first to use a sequential file command. If the file did not already exist, the random command would not open one. You can work around it by adding one line before you use the random command:

```
100 OPEN "O";#1, filename:CLOSE
```

Also, I found some typos in the section that explains the use of the file commands. There may be more but I haven't found them yet. Another thing to be aware of is the compatibility with other cards. The Softcard will not work with many of the accessory cards available for the Apple. For instance, the Softcard will not recognize the existence of the D.C Hayes Modem. To use it with the Softcard, special software will be required. If you should want to use this system, you should check to see if you can use other boards you may have. For the most part, I find it has features similar to the Language System. If you are using the Language card and so on, The Softcard will be similar in it's relationship to peripherals.

In addition to the Z80 based circuit board, the system comes with 2 half page manuals and two system diskettes. The manuals are divided between the system description and CP/M in one and Microsoft Basic version 5.0 in the other. The manuals are about half-page size. They

```

LIST
2 REM
MOVING TITLE DEMONSTRATION
5 REM
WRITTEN BY BOB SANDER-CEDERLOF
JULY 7, 1980
10 Q = - 16336: TEXT : HOME
30 FOR J = 1 TO 2: VTAB J * 4 +
  2: HTAB 4: FOR I = 1 TO 34:
  PRINT "X";: NEXT I: PRINT :
  NEXT J
80 A$ = "MOVING TITLE DEMONSTRATI
  ON": REM PUT YOUR
  OWN TITLE HERE
90 FOR I = 1 TO 19: + LEN (A$) /
  2:P = PEEK (Q) + PEEK (Q):
  VTAB 8: HTAB 40 - I: PRINT
  LEFT$ (A$,I) " ": NEXT I
95 FOR I = 1 TO 3000: NEXT I: REM
  DELAY SO PEOPLE CAN READ THE
  TITLE
100 REM PUT THE REST OF YOUR PRO
  GRAM HERE.
110 HOME : LIST ,100: FOR I = 1 TO
  3000: NEXT I: END : REM TO
  SAVE YOU THE TROUBLE...
J

```

Listing 3

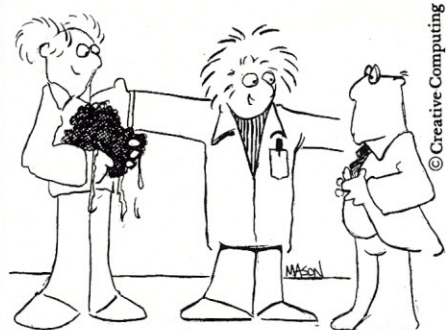


prop nicely in front of you so you can view them easily. There is a lot of information in the manuals so expect to spend a lot of time becoming familiar with the contents. I have never worked with CP/M before, so it was all new to me. I have heard a lot of pros and cons about the merits of CP/M. Once you become familiar with one, no other ever seems quite right. There are a number of utilities to let you do many things that you can't do with the Apple operating system. So learn to use the tools and accept it as another part of the learning experience. Everything is easy once you understand it.

The Basic manual includes a description of the commands and functions of the language. It is intended for the experienced programmer. There are only occasional examples as required to emphasize a point. Also included in the manual are the requirements for calling 6502 routines from the Z80 system. The implementation seems to be well integrated into the two systems since you are not able to detect any interferences. All the keyboard inputs have to pass from the 6502 to the Z80 as do the screen functions and the links to your printer and so on.

Operation of the system is provided by programs included on two diskettes. One diskette is for the standard 13 sector DOS systems. With this disk you get CP/M and MBasic. This version of Basic includes low resolution graphics commands. When this disk is used and MBasic is loaded, you have a little over 14K of memory left. The other diskette is for use with the Language System or with DOS 3.3. The 16 sector system includes hi resolution graphics with Basic as well as the lo res version. In the 16 sector system, you have about 26.5K of memory with MBasic and 17.5K of memory with GBasic.

The system is sure to be well supported by Microsoft. And, eventually there will be Apple CP/M software. I'll be telling you more about the Softcard from time to time.



"Jeffers here is the one with all the brains!"

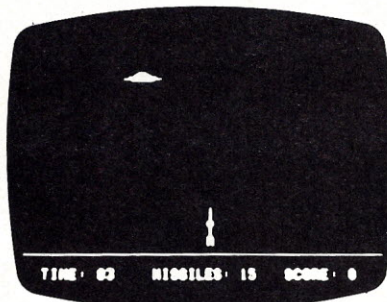
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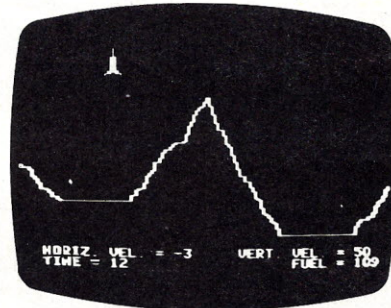
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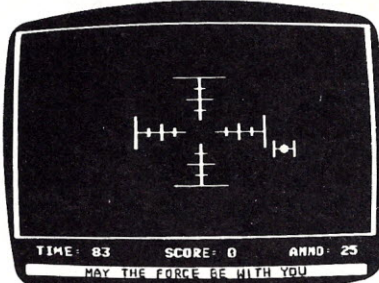
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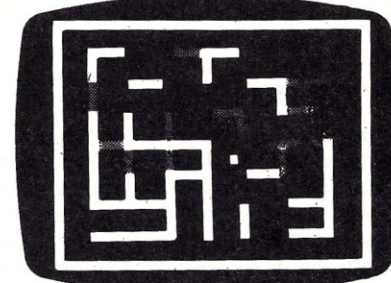
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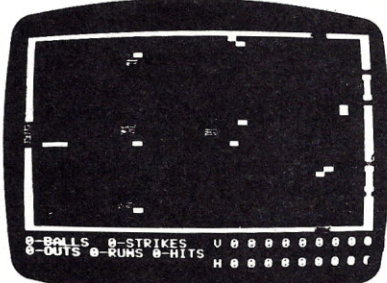
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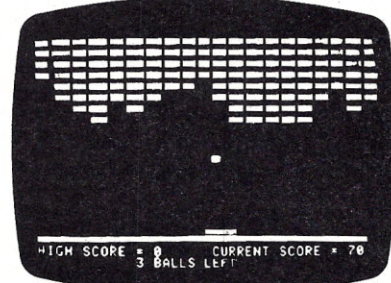
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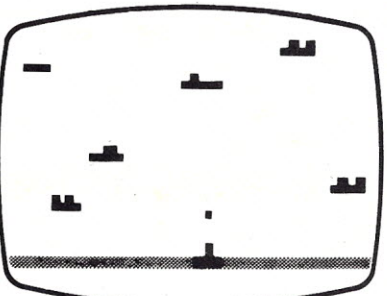
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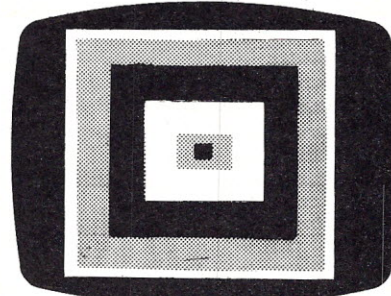
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# Outpost: Atari



**George Blank**

## View from the Outpost

The new year brings a lot of promise to Atari owners. We should soon be getting Pascal and a Microsoft Basic, accounting software, and for those of us who prefer to enjoy our computers, a batch of new games. Atari has announced Space Invaders for the 400 and 800 as their first machine language cassette. This game has become one of the most popular arcade and computer games, and I look forward to getting a chance to play it.

We can also expect to see an explosion in Atari software available from sources other than the manufacturer. Just this past October Sensational Software announced Trivia Unlimited, Outdoor Games, Haunted House, Air Traffic Controller, Hail to the Chief, Ecology Simulations I and II, Social and Economic Simulation, Story Time, Oregon Trail, and Stock and Options Trading Analysis. We can only benefit from the wide variety of programs coming out.

There has been a change in the climate for outside software houses in the past year. When appliance type small computers became available, the manufacturers wanted to keep the after market to themselves. In June of 1980 Radio Shack compiled and released through their stores a list of over 1000 programs available from other sources. Exidy and Texas Instruments have been running contests to stimulate software development, with T.I. even sending representatives to most of the major software houses, offering them computers and support in developing software for the 99/4. Apple has cooperated in many ways with software publishers, even allowing mailings to the Apple warranty list.

Atari has been very cooperative from the start. As soon as they knew of outside suppliers they started sending out mimeo-

graphed sheets listing programs, prices, and publishers. Recently they invited the sources they knew to submit leaflets for free distribution to the Atari warranty mailing list, and by the time this column comes out many of you should have received the resulting package. If you did not send in your warranty card, you are missing out!

## Bytes, Nibbles, and Bits

The remainder of this column will be discussing the internal workings of the Atari computer. In order to understand what is happening there, you will need to know a little about the binary number system. If you have a binary brain and already think in ones and zeroes, just skip to the next heading while I attempt to explain the binary system to everyone else.

We human beings tend to think numerically in the decimal system, probably because our ancestors used their fingers as counting tools, and they just happened to have ten fingers. Computers have neither fingers nor our intellectual capacity, so they have to rely on a simpler system. While we have ten different numerals, from 0 to 9, for use in our calculations, the computer can only choose between two states, off or on, for which we use the digits 0 and 1.

To a computer, any given operation usually involves a switch or light that is either on or off, an electrical charge that is either positive or negative, or a magnetic charge that is polarized either "north" or "south".

Let us think about a single digit counter on an assembly line. If it is a decimal counter, it starts at 0, and when the first object passes, it becomes 1, then 2, and so on until it reaches 9. As the next object passes, the counter goes back to zero. If we wish to continue counting, we need to add another digit, which can count 99

objects, or 100 if you know whether the 00 is the starting position or the ending position.

If the counter is a binary counter, it starts at 0, goes to 1, and then has to reset back to 0 again. If you want to count even as far as 3, you need 2 digits. Where each position in the decimal system represents a power of ten, each position in the binary system represents a power of two. Let us take the number 111 in both systems as an example. In the decimal system 111 represents 10 squared, (100) plus 10 to the first power, (10) plus ten to the zero power, (1). The total is one hundred and eleven.

Now, let us consider the same group of three digits as a binary number. It now becomes 2 squared, (4) plus 2 to the first power, (2) plus 2 to the zero power, (1). The total is seven. Since we read numbers from left to right, here is a table of the meanings of the positions in a number under the decimal and binary systems:

Number	1	1	1	1	1	1
Decimal	100,000	10,000	1,000	100	10	1
Binary	32	16	8	4	2	1

Using this system, we can now count in the binary system, with the numbers 0 to seven displayed as follows:

Zero	0 0 0	Four	1 0 0
One	0 0 1	Five	1 0 1
Two	0 1 0	Six	1 1 0
Three	0 1 1	Seven	1 1 1

Each digit in the binary system is represented by a single electrical charge in the computer. This is an actual circuit in the computer that has a positive or negative charge. This amount of information is called a Binary digIT, usually referred to as one BIT. Since the central processor on most computers handles eight bits at a time, we also need a term to refer to a group of eight bits, which can give us numbers from zero to two hundred and fifty five. The common term for eight bits is a byte, and the internal memory of the Atari is organized in bytes. Thus, if you have 32K of memory,

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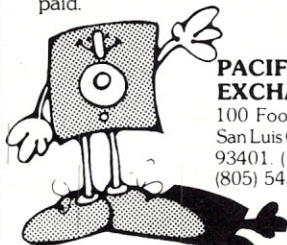
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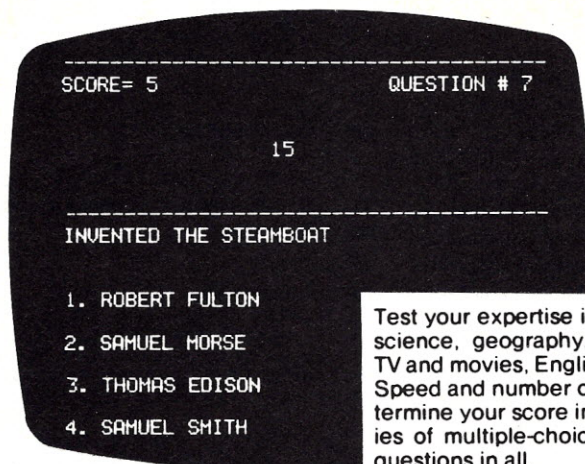
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JANUARY 1981

# Atari Software

## Trivia Unlimited

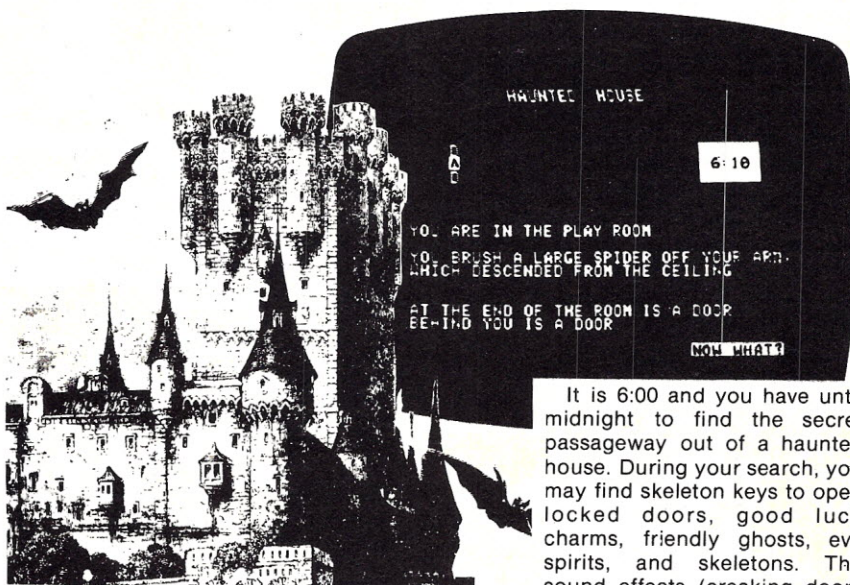


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It is 6:00 and you have until midnight to find the secret passageway out of a haunted house. During your search, you may find skeleton keys to open locked doors, good luck charms, friendly ghosts, evil spirits, and skeletons. The sound effects (creaking doors and stairs) add to the eeriness. The house layout changes in every game.

Other Atari Software —

- Outdoor Games (Forest Fire, Fishing Trip, Treasure Island 1 & 2), Cassette CS-7002, \$11.95
- Outdoor Games and Haunted House, Disk CS-7502, \$24.95
- Hail to the Chief (Presidential election simulation) Cassette (32K) CS-7201, \$24.95; Disk (40K) CS-7701, \$24.95.

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## Atari, continued...

you have 32,767 bytes of memory, or 262,136 bits. The reason that 32K is 32,767 instead of 32,000 is that we are organized on the binary system, and 32,000 is not an even power of two. The number 32,767 is two to the 14th power. There is one other term that is occasionally used, for a group of four bits. Four bits, or half a byte, is known as a nibble.

### Player Missile Graphics

Ted Nelson wins my nomination as the most organized editor in computerdom. Way back in September he sent out a list of editorial features for *Creative Computing* from October 1980 to December 1981. The features scheduled for this month are graphics and animation, digital music techniques, and interactive video disc articles. As a computer addict, I have no money to spare for a video disc, and my musical ability leaves much to be desired. That leaves me with graphics and animation for this column!

The Atari computers have many powerful graphics features, but the better techniques require special knowledge of the hardware and tricky programming. I hope that by giving a sample program and telling how it works, I can open the door to the mysteries and get many of you started.

Let me begin by acknowledging a great deal of help from Atari, especially from Lane Winner, who gave me the sample program presented here and explained it, and to others on the staff who provided me with well over 1000 pages of documentation, preliminary manuals, printouts, programs, and even memos explaining the working of the computer. I also need to credit Rich Bouchard, SoftSide's brilliant systems programmer, for converting all my hexadecimal addresses to decimal for your benefit. I must confess that I tend to think in hexadecimal.

```
100 DIM A$(10),B$(100)
200 GRAPHICS 8
```



"That Turkey! I told him Graphics language, not graphic language."

```
210 POKE 559,62
220 POKE 53248,120
230 POKE 704,88
240 I=PEEK(106)-8
250 POKE 54279,I
260 POKE 53277,3
270 POKE 53256,3
280 J=I*256+1024
300 FOR Y=J+120 TO J+137
310 READ Z
320 POKE Y,Z
330 NEXT Y
400 FOR X=48 TO 221:GOSUB 500:NEXT X
410 GOTO 400
500 POKE 53248,X
510 RETURN 100 DIM A$(10),B$(100)
600 DATA 60,60,60,60,60,60,60,255,255,
255,255,255,255,60,60,60,60,60,60
```

### How The Program Works

Line 210 specifies the regular playfield in single line format as a background, from six possible options.

Codes:

```
61 narrow field (128 dots)
62 regular field (160 dots)
63 large playfield (goes off screen)
45 double line narrow playfield
46 double line regular playfield
47 double line large playfield
```

Line 220 tells the horizontal position register to put player 0 at mid screen (location 120). The regular playfield ranges from 48 to 221. The horizontal position registers are at the following locations in memory:

Player 0	53248
Player 1	53249
Player 2	53250
Player 3	53251
Missile 0	53252
Missile 1	53253
Missile 2	53254
Missile 3	53255

It is possible to combine the 4 missiles into a fifth player.

Line 230 sets the color of Player 0 and Missile 0 to Pink. You can write directly into the color registers starting at 704, or indirectly through the hardware chip starting at location 53266.

#### Chart of Color Locations

Player/Missile 0	704	or	53266
Player/Missile 1	705	or	53267
Player/Missile 2	706	or	53268
Player/Missile 3	707	or	53269
Playfield 0	708	or	53270
Playfield 1	709	or	53271
Playfield 2	710	or	53272
Playfield 3	711	or	53273
Background	712	or	53274

Understanding the color system requires binary arithmetic. The least significant bit of the color byte is not used, and is identified with an x in the diagrams. Bits 1 to 3 carry the luminance, from black (0 0 0 x) to white (1 1 1 x). Bits 4 to 7 contain the color, as follows: (b represents the luminance bits)

Grey	( 0 0 0 0 b b b x )
Gold	( 0 0 0 1 b b b x )
Orange	( 0 0 1 0 b b b x )
Red Orange	( 0 0 1 1 b b b x )
Pink	( 0 1 0 0 b b b x )

Purple	( 0 1 0 1 b b b x )
Purple Blue	( 0 1 1 0 b b b x )
Blue	( 0 1 1 1 b b b x )
Blue	( 1 0 0 0 b b b x )
Light Blue	( 1 0 0 1 b b b x )
Turquoise	( 1 0 1 0 b b b x )
Green Blue	( 1 0 1 1 b b b x )
Green	( 1 1 0 0 b b b x )
Yellow Green	( 1 1 0 1 b b b x )
Orange Green	( 1 1 1 0 b b b x )
Light Orange	( 1 1 1 1 b b b x )

Line 240 looks at the pointer to the top of memory. The top of memory is identified by 256 byte "pages". Thus, if this location had the number 100 (decimal), the top of memory would be at byte 25,600 (256 times 100). We subtract 8 from this number, because we want to save 8 pages (2048 bytes) for our graphics at the top of memory.

Line 250 places the address calculated above as the beginning of our graphics area in the Player/Missile Base Address Register which is at location 54279.

Line 260 tells the Graphics control register to enable player missile graphics. Only the three least significant bits of this register are active, as follows:

( x x x x x x 0 )	Player missile graphics not enabled
( x x x x x x 1 )	Player missile graphics enabled
( x x x x x x 0 x )	Direct memory access to player graphics disabled
( x x x x x x 1 x )	Direct memory access to player graphics enabled
( x x x x x 0 x x )	Trigger latches disabled
( x x x x x 1 x x )	Trigger latches enabled

Note that once direct memory access is enabled, it continues until it is disabled again. If you press break and list this program, you will see the player as a moving vertical line on the screen. To return to a normal display, you must type POKE 53277, 0.

Line 270 sets the size register for Player 0 to four times normal size. Each player or missile can be the full height of the screen. Actually, they extend beyond the top and bottom. But players can only be 8 bits wide, and missiles 2 bits wide. There are dedicated microprocessor chips in the Atari computers to control these players and missiles. We change the size with a POKE into the size registers at the following locations.

Player 0 size	53256
Player 1 size	53257
Player 2 size	53258
Player 3 size	53259
Size for all missiles	53260

The following values are allowed. Only the two least significant bits are used for the player registers. The missile register is grouped so that each two bits represent a different missile.



Value	Result
0 or 2	Normal size
1	Twice normal size
3	Four times normal size

Line 280 points to a memory location 1024 bytes (1K) after the beginning of the Player Missile Base address we established in lines 240 and 250 for our binary description of player 0. Remember that the player can extend from beyond the top of the screen to below the bottom of the screen. Actually, 256 bytes of information are reserved for player 0, beginning 1024 bytes past our base address.

We now need a memory map of the Player Missile bit map area. Actually, there are two possible memory configurations, depending upon the value in location 559 (see the explanation for line 210 above). If we have single line graphics, with 61, 62, or 63 in location 559, then the memory is used as follows:

Offset from Base Address	Use
0 - 767	Not used
768 - 1023	Missiles 0 - 3
1024 - 1279	Player 0
1280 - 1535	Player 1
1536 - 1791	Player 2
1792 - 2047	Player 3

If double line graphics are used, with 45, 46, or 47 in location 559, you only need 1K, or 4 pages of memory. (see below for program changes.) Then the offset is as follows:

Offset from Base Address	Use
0 - 363	Not used
364 - 511	Missiles 0 - 3
512 - 639	Player 0
640 - 767	Player 1
768 - 895	Player 2
896 - 1023	Player 3

Note that the missiles are stored in memory as a single player. When you are using missiles and drawing your bit map, Missile 0 is bits 0 and 1 of each byte, Missile 1 is bits 2 and 3, Missile 2 is bits 4 and 5, and Missile 3 is bits 6 and 7.

Line 300 selects the memory location for our bit map. We are only going to draw a character 18 bytes high, at about the middle of the screen, so we will leave most of player 0 in the background color, and place information on our character in locations 120 to 137 of the memory reserved for player 0.

In lines 310 and 330, we read our binary shapes from data into the appropriate locations in player zero's reserved memory. Each number is a "bit map" of a horizontal slice of player 0, eight bits or one byte wide. Thus the number 60 represents the binary pattern 00111100. Each bit that is zero represents one location on the screen that is presented in the background color, while each one represents a memory location presented in the color set for player 0.

I selected a simple cross for demonstration program just to illustrate the principle. Here is a bit map of player zero:

Locations	Decimal	Bit map
0 - 119	0	0 0 0 0 0 0 0 0
120 - 125	60	0 0 1 1 1 1 0 0
126 - 129	255	1 1 1 1 1 1 1 1
130 - 135	60	0 0 1 1 1 1 0 0
136 - 255	0	0 0 0 0 0 0 0 0

To create your own players, just map out the bits and convert them into decimal numbers, then POKE them into the display list.

Lines 400 and 410 contain the horizontal positions for our player, and control its movement across the screen. Location 48 is the left edge of the screen and location 221 is the right edge.

Line 500 POKES the desired horizontal position of player 0 into the position register for player 0. Here is a chart of the memory locations for the horizontal position registers:

Player/Missile	Register
Player 0	53248
Player 1	53249
Player 2	53250
Player 3	53251
Missile 0	53252
Missile 1	53253
Missile 2	53254
Missile 3	53255

Line 600 contains data for the shape of our player, as described above in the description of lines 300 and 310.

If you are going to experiment with this program, I suggest that you add the following line:

```
340 PRINT "POKE 53277,0: GR.0: LIST"
```

This way, in order to change the program, all you have to do is press BREAK, move the cursor on top of the statement on the bottom of the screen, and press ENTER to turn off the direct memory access and list your program.

Use these changes to try double line graphics:

```
210 POKE 559,46
240 I=PEEK(106)-4
280 J=I*256+512
300 FOR Y=J+60 TO J+77
```

These changes specify a double line regular playfield, reserve only one page of memory instead of two, and adjust the bit map for the more compact memory storage.

Have fun playing with this information, and share your discoveries with me. The quickest way to reach me is at my home address listed at the bottom of the first page of each month's column. Letters sent through *Creative Computing*, The Boston Computer Society, *SoftSide*, Ramware, or The Software Exchange take extra handling and extra time. I regret that it is not possible for me to talk to you on the telephone or answer correspondence except through the column. □

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# Too Few Words

Edmond H. Weiss teaches effective writing seminars for business, industry, and government. To contact him, call (609) 795-5580.

The subject of this month's column is counterproductive language compression excesses. That is, reader-inhibiting, space-saving text economies. The column aim is a language interpolation principles demonstration for effectuating communication accessibility advantages.

Now, if you found that first paragraph hard to follow, congratulate yourself. You have the good sense not to waste your time in deciphering that cryptic passage.

This column is for people who write paragraphs like my first one: people who use too few words. Although wordiness (too *many* words) is the more common problem, compression (too *few* words) is often harder to recognize and correct.

Compression is the evil effect of a noble cause. Sadly, too many writers—motivated properly to keep their texts short and concise—throw away words that are useful or necessary for understanding. Then, they squeeze the remaining words into a dense, impenetrable mash of sentences, which, though grammatically correct, are barely readable.

I blame most of this compression on three mistakes:

- Careless Stringing
- Reckless Chopping
- Heartless Stripping

## CARELESS STRINGING

Among the easiest ways to remove little words from your sentences are, first, stringing modifiers before a noun, second, stringing nouns, and third, stringing modifiers *and* nouns. Easy, but dangerous.

For example, a misguided writer will convert *methods that reduce cost and prevent delay* to *cost-reducing, delay-preventing methods* (a string of modifiers).

Or, the same writer might convert—

This language is easily learned because it permits you to generate reports with statements that resemble plain English.

to—

This language has an easily-learned English-like report generating capability.

True, the second sentence is shorter than the first. But it is also impossible to understand (unless you have read the earlier, longer version).

Even more characteristic of the computer literature is the noun string (excuse me, string of nouns). Obviously, no mere mortal can make sense of such phrases as *language interpolation principles demonstration* (four nouns). But what may be less obvious is that most readers cannot make sense of a string of *two* nouns. What, for example is a *management option*? Is it a choice for managers to make, or one of several ways to manage, or something else? What is a *user evaluation*? Is it an evaluation of the users, *by* the users, or *for* the users?

When the modifiers and nouns are strung together, the results vary from tortuous to ludicrous. What can anyone make of—

- non-fossil fuel energy source
  - operator-induced failure rate increase problem
  - integrated distributed processing plan report
  - long range security leak reducing plan
  - operational planning materials format design criteria
  - structured analysis graphics approach
- Some of the strings are just funny. One government agency advertises for a *short contracts expert*. (Tall ones need not apply.) A utility company hires a *buried cable engineer*. Somewhere, I am sure, there is someone who calls himself a *floppy disk*

*salesman*. (he works beside the *fat processing technician*.)

The point is simple. Strings of nouns and modifiers are obscure and ambiguous; their meanings twist and turn as you look at them. Do not, for the sake of economy, drop the little prepositions and function words that would turn *dissolving pulp customer* into *customer for dissolving pulp*. Use your judgment. *Data base* is safe; *data base manager* is safe; even *data base management system* may be safe (in some places). But almost no one knows what a *card holder file* might be. And nary a soul can make sense of *contiguous sector reference designator*.

## RECKLESS CHOPPING

Much compression is due to overzealous cutting and chopping. Some writers act as though they were preparing telegrams and, therefore, excise all the articles. The "telegrapher" writes:

- Please read attached instructions.
- When creating new file, ensure new name not assigned to old file.

Others act as though they might be assessed or penalized for every extra word they use. They write—

We believed the analyst would solve the problem. instead of—

We believed *that* the analyst would solve the problem. (The omitted *that* in the first version invites the reader to stumble on the phrase *believed the analyst*.)

Still other writers—and even a few professional editors—will hack away at transitional words and phrases. They'll chop every *for example* or *in contrast* or *further*. They'll toss out every introductory *obviously* and *certainly* and *unfortunately*. Unfortunately, these words they have cut are just the words that show the reader the logic and flow of the paragraph. An innocent *to illustrate* ties the second sentence to the first. An *on the one hand* warns the reader that the next two sentences are the contrasting halves of one thought.



## HEARTLESS STRIPPING

Some of this overzealous chopping and cutting is *heartless*: a deliberate attempt to strip the moods and feelings, the intensities and the urgencies, from the text. Desiring to be concise and detached, some writers will mistakenly strip away any extra word that is used to emphasize, or characterize, or underscore a statement.

The heartless strippers remove those little, invaluable words of emphasis: *even, only, especially, unusually....* (Granted, some writers abuse these qualifiers. I am concerned here, though, with the ones that almost never use them, the ones who seem afraid of them.)

To make matters worse, most technically trained writers and editors have a neurotic fear of repetition (redundancy, they call it) and, in stripping repeated words and phrases from their drafts, they deprive themselves of the single most effective way to underscore a point or guide a reader through a difficult idea. To illustrate, consider this splendid, redundant sentence written by Peter Drucker:

Profit and profit alone will provide the capital for tomorrow's jobs: not just for *more* jobs but for *better* jobs.

The typical technical editor would probably ruin this sentence, turning it into—

Profit will provide the capital for more and better jobs.

Notice, though, that even though the first sentence is longer, it has a virtue that the second lacks: *It cannot be misunderstood.* The tech editor's version may be logically equivalent to Drucker's but Drucker's cannot be misread. Drucker anticipates the reader and clears away every possible misinterpretation with deliberate repetition and emphasis.

The final point, then, about too much compression (too few words) is that it often comes from a mistaken conception of the reader as a perfect, logical processor of information—someone who can extricate every possible fact and relationship from your logically-tight, efficiently-worded manual or report.

Readers, though, are not like that. They cannot infer and impute all your meanings from a dense, terse statement. They cannot divine the grammar in your string of nouns. And even when they can, they usually won't.

So, emphasize, underscore, and repeat. The best writers—even the most concise ones—do it all the time.

### Personal Note

I'll be leaving this location for now. If you have enjoyed these last six columns, please look out for *One Hundred Bugs*, soon to be published by Creative Computing Press.

## Voodoo Castle The Count and Ghost Town

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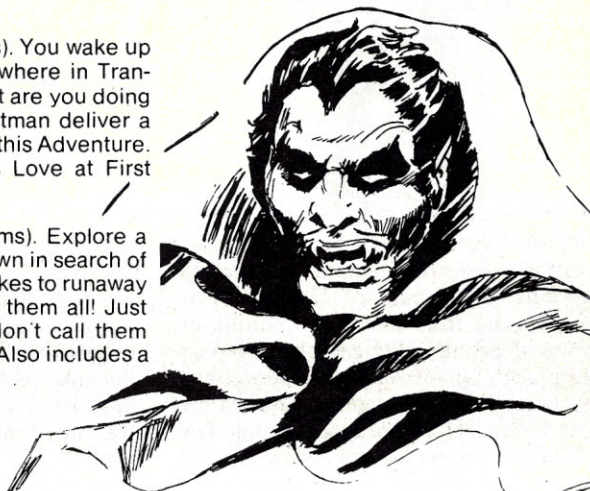
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## Harold L. Novick

Robert Gottschalk, whose name appears as Commissioner of Patents in the landmark Supreme Court case of *Gottschalk v. Benson*, the first so-called "computer program" patentability case, has been on a campaign for software protection since he left the Commissioner's position in the early 1970's. He now practices patent law in Chicago and serves as a consultant and expert witness to other patent attorneys. It seems that Mr. Gottschalk's worst fears may soon be realized.

Some quick background information for those of you who just tuned in. The *Benson* case involved the attempted patenting of a newly discovered mathematical algorithm that was used in digital telephone equipment to convert from binary coded decimal numbers to pure binary numbers. The single sentence legal description of the invention, the "claim", was in the form of a "method of converting signals from binary coded decimal form into binary" and the patent application was directed to "the processing of data by program and more particularly to the programmed conversion of numerical information" in a general purpose digital computer.

The decision of the Supreme Court by Justice Douglas characterized the claimed invention as a mathematical formula that "has no substantial practical application except in connection with a digital computer, which means that (if granted) the patent would wholly preempt the mathematical formula and in practical effect would be a patent on the algorithm itself." In one interpretation of the decision, the Supreme Court was merely adhering to its age-old rule that only applied technology can be patented and that "(p)henomena of nature, though just discovered, mental processes, abstract intellectual concepts, are not patentable, as they are the basic tools of scientific and technological work." In a sense, the Supreme Court denied patent protection because the applicant was

claiming not the application of a newly discovered mathematical algorithm, but the algorithm itself.

If that was all Justice Douglas said in the 6-0 decision (three of the nine justices did not take part in the case), then it would have been a decision that perhaps ended the problems. But Justice Douglas continued: "If these programs are to be patentable, considerable problems are raised which only committees of Congress can manage. ...The technological problems tendered in the many briefs before us indicate to us that considered action by the Congress is needed."

It is clear that the court did not appreciate the nature of the beast that it held not to be patentable. But that is not unusual, considering they were dealing with "computer programs." Try and conceptually define a computer program. Then, ask your friends. If you ask nine friends, you will end up, including yours, with eleven different answers. To put it bluntly, computer programs are a weird bird, unlike anything else.

Consider the copyright side of the question. For those readers who have read last month's *Forum*, there will be an appreciation of the difficulties that a Chicago federal district court judge had when he held that a ROM was not a "copy" of a computer program. (This is the so-called CompuChess case). He said that notwithstanding (i.e., "despite" for those readers for whom legalese does not compute) the assumption of both the plaintiff, Data Cash Systems, Inc., and the defendant, JS&A Group, Inc., that it was a "copy." A "copy" is defined by court decisions to be "a tangible object that was a reproduction of the original work." The judge analogized the ROM to a completed building. At law a building is not a "copy" of the architectural plans upon which it is based. An architectural plan is a technical writing which is capable of being copied only by similar technical writings, i.e., by other plans. A building is the result of

plans not a "copy" of them. It follows that at common law, (i.e., judicial interpretation as opposed to legislative statute) a copy of a computer program is another computer program in its flow chart or source phase because these are comparable technical writings. While the ROM is the *mechanical embodiment* of the source program, it is not a "copy" of it. (Emphasis added, court citations deleted).

The Chicago judge has been soundly criticized for his holding. But it was his misappreciation of the nature of a computer program that led to his errors. (Technically, the judge was correct that under the old law, a ROM is not a "copy" because that law, written in 1909, required that a copy must contain information that is perceivable to the naked eye of the reader. The new law, effective in 1978, did not. The judge, not understanding computer programs, applied the wrong law.)

Another view from the copyright perspective of the uniqueness of computer programs is the basic principle that only an expression of an idea is copyrightable, not the idea itself. One copyright expert has asked, "Is it possible to render protectable the 'expression' of a program without necessarily granting a monopoly in its 'idea', i.e., in the methodology or process adopted by the programmer?" 1 Nimmer on Copyright S2.18(J) (1980). For example, a computer program is usually used by reading it into the working memory of a computer. Does this make a copy? or, is this the use of a methodology or process?

John Hersey, a famous author and a Commissioner on the Congressionally established National Commission on New Technological Uses of Copyrighted Works (CONTU), dissented from the commission's recommendation that "computer programs, to the extent that they embody an author's original creation, are proper subject matter of copyright." Mr. Hersey likens the object code to a cam. The program, now in its "mature and usable form, is a machine-control element, a mechanical device ..."

Harold L. Novick, Patent Attorney, Larson, Taylor & Hinds, Arlington, VA 22202.



"We take it as a basic principle that copyright should subsist in any original work of authorship that is fixed in any way (including books, records, film, piano rolls, videotapes, etc.) which communicate the work's means of expression." But a program, once it enters a computer and is activated, does not communicate information of its own, intelligible to a human being. It utters work. ...The mature program is purely and simply a mechanical substitute for human labor." Commissioner Hersey concludes that "a computer program in the form in which it is capable of being used to control computer operations" should not have copyright protection.

The simple answer to Commissioner Hersey is that he is talking about the use of a computer program. Object code is understandable by humans and can communicate ideas to humans. Many programmers can write in object code. This author wrote many programs in 8008 object code.

Even lawyers arguing before the Supreme Court have trouble agreeing as to what a computer program is. In the oral arguments of two cases about the patentability of "computer programs" heard by the Supreme Court on October 14, 1980, the two lawyers arguing that their respective inventions were patentable and the government lawyer opposing their contention all agreed that computer programs should not be patentable. Where did they differ? The government lawyer, Assistant Solicitor Wallace, claimed that the *Bradley* invention to a computer system (claimed hardware) that included a novel firmware module and the *Diehr* invention to a process of vulcanizing rubber using a programmed computer to control the processing time were computer programs. The *Bradley* and *Diehr* attorneys strongly argued that the inventions were not claimed as computer programs.

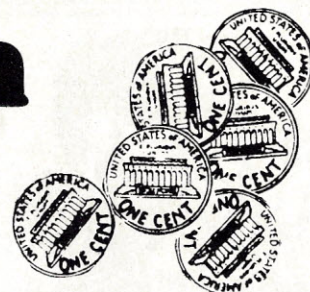
The CompuChess judge, John Hersey, and Mr. Nimmer, all suffer from the problem of defining a computer program. What is a computer program? Trying to protect it with any present day legal mechanisms such as patents, copyrights, or trade secrets is like trying to ram home a square peg in any one of three round holes.

Robert Gottschalk has been arguing, preaching, and cajoling for almost a decade that computer programs need a new form of protection. They are too valuable to be left alone. The Supreme Court in 1972 told Congress to do something. Nothing has been done. In a sense, computer programs are like "poor old Charlie", left riding on the MTA (the Boston subway), in the Kingston Trio's song, when the fare was increased and he was without funds to get off. They are caught in a legal squeeze.

What should the reader do? What can he or she (or it, for mechanical readers) do? Write your state and federal representative. Get Charlie program off the mechanical and Transfixed Appellation. □

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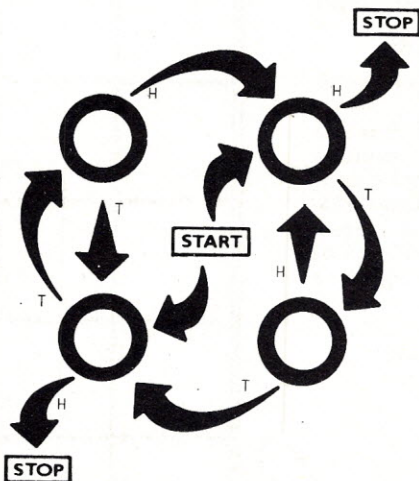
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# puzzles & problems



## The Monkey's Uncle Puzzle

W

illard Wordsworth, "The Word Professor" from Camelot University, is back to kick off this session of "Merlin's Puzzler's." Willard has one of his famous "change-the-word" puzzles for us to wrack our brains over. In this type of puzzle the object is to change the word in the top row to the word in the bottom row in the fewest possible moves. During each move the puzzler must change one letter in the word so that a new word is formed. (For example: You can change the word WARM into the word COLD using the following four moves — WARM, WARD, WORD, CORD, COLD). (This puzzle is from "Merlin's Puzzler 3").



## A Barrel Of Fun

he donnish looking chap pictured here is cogitating over a legal problem presented to him by one of his students. It seems that a wine merchant had died and left an estate consisting of 21 wine barrels. Seven of the barrels were full, seven were half-full, and, the remaining seven were, alas, empty. The merchant had stipulated that each son was to get an equal share of full, half-full, and empty wine barrels. The problem is to find the simplest method in which to accomplish the terms of the will. The don's first solution was for the sons to drink up all of the wine and then divide up the empty barrels, a solution that while being practical, is not the one that the student had in mind.



## Just One Over

man, being asked how many coins he had in his pocket, replied, "If I divide them by 2, by 3, by 4, by 5, or by 6, I shall always have one over." What number had he?

61



A	P	E
A	D	D
A	I	D
L	I	D
L	A	D
M	A	D
M	A	N



## The Davenport Puzzle

ere's one of Merlin's favorite puzzles.

At the right we have a puzzleboard that has been divided into 36 squares. The puzzler is required to place 12 small coins on this board in such a manner that there will be two coins in each horizontal row, two coins in each vertical row, and, two coins in each of the two corner diagonals. Only one coin can be placed in any one square. (This puzzle appears in "Merlin's Puzzler 1").

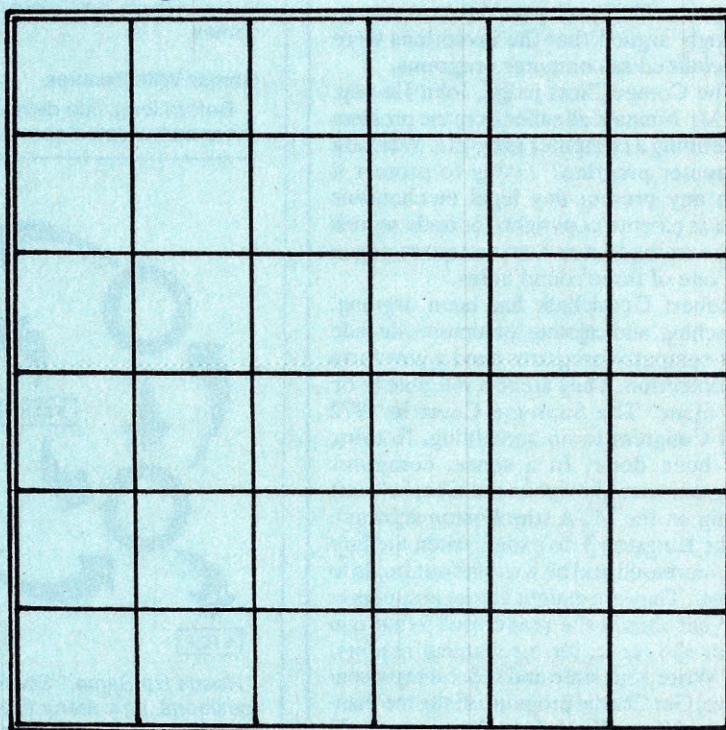
If you have a puzzle to share with our readers send it in, and, if Merlin uses it he will send you a copy of one of his books.

Until next month, good puzzling.

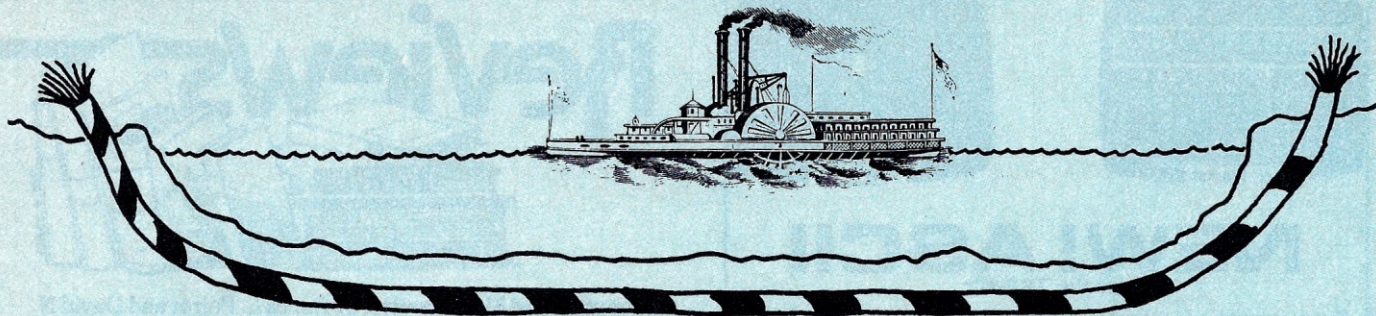
Your editor,

*Charles Barry Townsend*

Charles Barry Townsend







## The Right Connections Puzzle

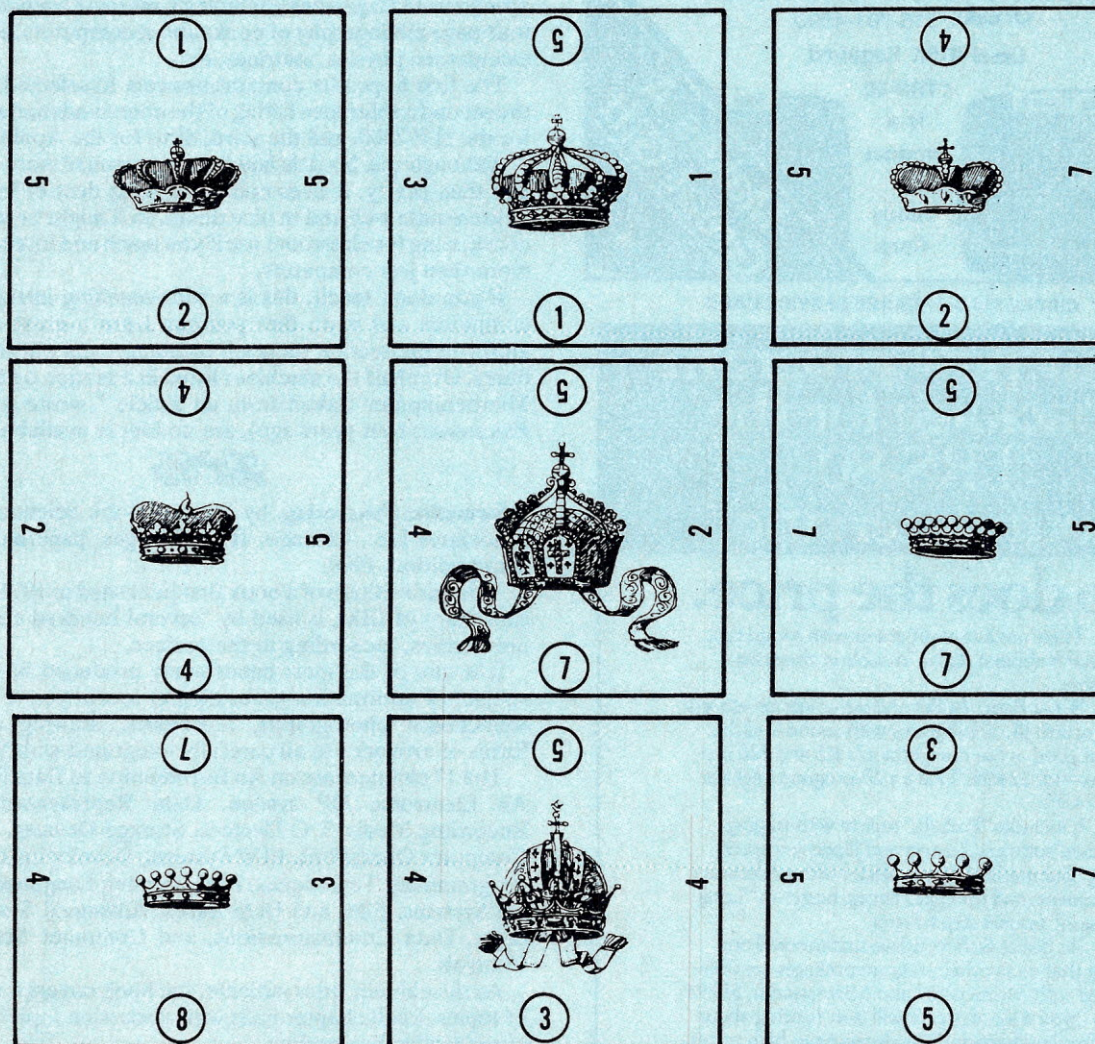


his "Brain-Buster" puzzle was contributed by Mr. Wesley M. Shaw of Warner Robins, Georgia. For submitting this problem Merlin is happy to send Mr. Shaw a copy of "Merlin's Puzzler 1".

You are given the task of correctly labeling both ends of a 1 mile long cable assembly spanning the Ochewata River. There are ten identical wires in this cable. You must match corresponding numbers to each end (i.e., #1 labeled wire on

one side must match #1 labeled wire on the other side). You are equipped only with 1) 20 one-foot jumper wires, 2) a continuity checker, 3) one round trip ticket on the Ochewata ferry, 4) 10 one-foot lengths of light twine, 5) one bottle of extra strength Tylenol.

Information: 1) The cable is buried beneath the river, therefore, the ends cannot be brought together for direct continuity comparisons (see above illustration). 2) The ends of the wires are stripped but one foot of insulation is exposed before entering the cable. 3) You have all the equipment necessary to solve this puzzle.



## The "Royal Aquarium" Thirteen Puzzle

This is an adaptation of the "Magic Square" idea, but modified in a very ingenious manner, the ordinary processes for forming a magic square being here quite inapplicable.

The puzzle consists of nine cards, not quite 1½ inches each way,

each bearing four numbers, radiating from the center, after the manner shown above. The figures shown circled are in the original printed in red. The experimenter is required to arrange the nine cards in a square, the red numbers forming perpendicular lines, and the black numbers horizontal lines, the three figures in each line, whether horizontal or perpendicular, making, when added together, 13. (From "Merlin's Puzzler 2").

Answers on page 192.





**Stock Market**



**Sea Wolf**

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**Computers and Mathematics**, by James L. Poirot and David N. Groves. Sterling Swift Publishing Co., Box 188, Manchaca, TX 78652. 463 pages, hardcover \$21.95. 1979.

Designed as a text for an introductory course on computers, this book covers a great deal of ground, including flowcharting, Basic and Fortran, error analysis, Boolean algebra, careers, calculators, small computers, statistics, matrices, and 15 pages lifted bodily (with permission from the "Basic Statements and commands" section of Radio Shack's TRS-80 Level II manual.

Such a wide variety is unique in this kind of book, which also includes a dozen pages that list almost 900 references to articles in 14 magazines (including *Creative Computing*), and a four-page bibliography of books about computers, computing, calculators, physics, matrices, etc.

The first appendix contains answers to selected exercises, the second a reference listing of the commands and statements for the H-P 2000, and the third, ditto for the Apple II.

Although this book is laid out in a manner more workmanlike than pretty, it does contain a great deal of information written quite well and in nice detail, so it might be worthwhile considering for classroom use if you teach and intend covering more than just computers.

If you don't teach, this is a wide-reaching introduction to computers and math that you can learn a great deal from, although the section on small computers got out of date in a hurry. Over half the machines listed in a section on Selecting a Microcomputer (taken from an article I wrote for *Popular Electronics* four years ago), are no longer available.



**Information Processing**, by Marilyn Bohl. Science Research Associates Inc., Chicago, IL. 507 pages, paperback \$12.95. Third edition, 1980.

This third edition of a book first published in 1971 by SRA, a subsidiary of IBM, is used by "several hundred colleges and universities," according to the preface.

It is one of the most handsomely produced books on the subject of information processing in recent years. The many well-chosen photographs, flowcharts, drawing and other forms of artwork are all carefully integrated with the text.

The 17 chapters are on An Introduction to Data Processing, An Electronic DP system, Data Representation, Data-Recording Media, I/O Devices, Storage Devices, The CPU, Computer Operations, EDP Systems, Developing a Program, Programming Techniques, Programming Languages, Operating Systems, Files and Data Bases, Advanced Systems Concepts, Data Communications, and Computer Security and Controls.

As the chapter titles indicate, the book covers a wide range of topics. Each chapter ends with discussion topics and references for further reading.

The text, although detailed and well done, is written in a style that is workmanlike rather than conversational, unlike Prof. Gear's book (see review in this issue), which along with Bohl's book would make a nice pair of textbooks for introductory courses on computers.

It can also be recommended to anyone who wishes to learn a great deal about information processing, from WATFIV to flowcharting, from virtual storage to modems.

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## Steve Gray, et al

**Digital Computer Simulation**, by Fred J. Maryanski. Hayden Book Co., Inc., Rochelle Park, NJ. 336 pages, hardcover \$15.95. 1980.

This textbook was written to serve for a first course in simulation "at the junior, senior, or first-year graduate level in a computer science, industrial engineering, electrical Engineering, or business administration department."

The author assumes "prior high-level language programming and a limited amount of mathematical sophistication," because his book gets into double integrals, chi-square statistics etc.

The emphasis is on supplying the reader with enough background to perform a complete simulation experiment. To this end Maryanski covers specification, design, coding, debugging, analysis, validation and interpretation. Four simulation programming languages—GPSS, Simscript, CSMP, and Dynamo—are presented with detailed examples and exercises.

The basic principles of probability and statistics are included as an aid to the analysis and understanding of simulation results. In the final chapter, the applications and limitations of simulation are discussed to help the reader properly evaluate the impact of an evaluation study.

Each simulation programming language chapter contains one example, which grows as new features of the language are introduced. Sample listings and output from runs are provided with each example. This is one of the very few books where the printer output is reproduced large enough, and dark enough, for every line to be easily read. Except for three printouts in Ch. 3, that is.



**More Chess and Computers: The Microcomputer Revolution; The Challenge Match**, by David Levy and Monroe Newborn. Computer Science Press Inc., 9125 Fall River Lane, Potomac, MD 20854. 124 pages, paperback \$12.95. 1980.

This is a sequel to **Chess and Computers**, by Levy, who also wrote books for Computer Science Press on the 1975 and 1976 U.S. computer-chess championships.

**More Chess and Computers** is intended to bring the reader of the earlier book up to date on developments that have taken place in the field during the three years previous to its writing in June 1979. Levy says, however, that "it is by no means essential for those interested in the subject to have read the earlier work before they can follow the present one—simply consider **More Chess and Computers** as a state-of-the-art survey."

Levy is famous for betting that no computer program could beat him at chess. The first chapter describes the 1977/8 matches played as part of his challenge, which he won. There is now a \$5,000 prize "with no time limit, waiting for someone." Also, Levy is "prepared to wager up to \$10,000 that no-one collects the prize before January 1, 1984."

Other chapters are on State of the Art, Blitz Play, Computer Chess Tournaments, and Microcomputers and Chess. In the last chapter, Sargon is described as "currently the best of the microcomputer programs available," and Chess Challenger and Boris as "the most notable" of the systems designed to play only chess.

The appendixes cover computer-chess miscellany, An Unsolved Problem (how do the parameters of a tree search affect the performance of the search, in chess programming), Games From 1977 Tournaments (55 games, unannotated), and a bibliography.

Obviously, this book is strictly for the chess-playing computer, and as such is very well written and finely detailed.

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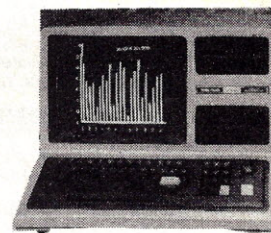
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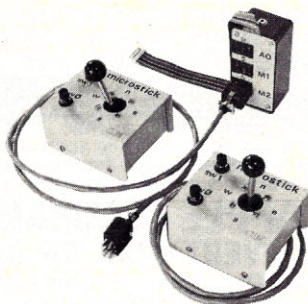
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**Problem Solving and Structured Programming in Basic**, by Elliot B. Koffman and Frank L. Friedman. Addison-Wesley Publishing Co., Reading, MA 460 pages, paperback \$12.95. 1979.

In the preface to this textbook, the authors "have taken a new approach to teaching an introductory programming course in Basic" because they "feel it is important to teach Basic in the same way that other high-level programming languages are taught. If Basic is to be used as a serious tool for software development, then the principles of structured programming must be applied in order to design effective, reliable software that is readily maintained."

To this end the authors use "the top down or stepwise approach to problem solving" and "three pedagogic tools: a data definition table, a flow diagram and a program system chart."

Three versions of Basic are used. "Each new control structure is introduced by first showing its flow diagram pattern and Dartmouth Basic form; afterwards its implementation in (Digital Equipment Corp.'s) Basic-Plus and standard (ANSI) Minimal Basic is described."

"An extensive set of homework programming problems is provided at the end of each chapter, and exercises are inserted in the body of each chapter. Solutions to selected exercises are provided at the end of the text."

The book starts to explain programming on page 11, with a simple payroll calculation that is built up slowly and carefully until by page 17 it is eight lines long.

Then the authors introduce timesharing, and go on to present a 16-line program to "compute trip time and cost," explaining it in full and very nice detail, yet packing much "annotated output" information in only three pages.

The rest of the book continues in the same fashion, offering much detail, relatively short and easily understood programs, plus many well-chosen programming problems exercises.

Once the reader gets used to the troika approach to showing how a particular statement is used in a program, and used to what may be the unique use (in a Basic book) of individual grey-colored memory-cell figures that give both the variable names and the data, he can profit a great deal from the wealth of information and detail presented.



**Small Business Programs**, by S. Roberts. Elcomp Publishing Inc., 3873L Schaefer Ave., Chino, CA 91710. 119 pages, paperback \$14.90. 1980.

These 32 programs are written in Microsoft Basic, and are available on cassette for several personal computers: 7 for PET, 10 for TRS-80, 4 for Sharp MZ80, 11 for Ohio Scientific Superboard.

Many of the 32 programs are small-business programs, such as inventory control, payroll, quotation, invoice, mailing list, depreciation, and sorting accounts. But some are of marginal use to the small-business man: conversion of physics units, hex-to-decimal conversion, alcohol concentration in blood, etc.

Most of the business-type programs are elementary, such as the payroll program, which does not calculate anything other than gross wages and, by subtracting savings and tax amounts found in DATA lines, net pay.

If you're a programmer, you might manage to enlarge some of these programs, and adapt them for your particular needs. If not, \$14.90 is a little too much pay for the seven programs that may be of interest to a small-business man: inventory control with economic order quantity, quotation, invoice, inventory, mailing list, depreciation, break-even analysis.

Then again, if you have absolutely no other source for such programs, the price may be right.

CREATIVE COMPUTING



**Computer Organization and Programming**, by C. William Gear. McGraw-Hill Book Co., NY 455 pages, hardcover \$22.95. Third edition, 1980.

First published in 1969, this introduction to machine-level programming and computer organization first discusses general principles and programming techniques, and then shows how to implement this information on four processors: the Cyber 170 and Intel 8080 (new to this edition), IBM 370 and DEC PDP-11.

The third edition also features a stronger emphasis on programming style and includes more material on processes, interrupt handling, I/O processing, and multiprogramming/multiprocessing.

Aimed at students who have taken one or two earlier courses in a procedure-oriented language, this edition discusses a specific microprogrammed processor (the AM 2901) instead of a hypothetical machine. The additional material replaces a chapter on compilers, which has been dropped.

The writing style is semi-conversational, the coverage very thorough, and the book's layout a model of clarity. This is probably the best textbook available on the subject. It is one of the three dozen books in McGraw-Hill's Computer Science Series.



**The Wounded Land** by Stephen R. Donaldson. Ballantine Books, New York. 497 pages, hardbound. \$12.95. 1980.

In real life, Thomas Covenant is a leper—that is his most salient characteristic. The ostracism he has suffered as a result of his physical condition has turned him into a thoroughly unlikable protagonist. In Donaldson's first trilogy, **The Chronicles of Thomas Covenant, The Unbeliever**, Covenant is an unwilling participant in a struggle between the forces of good and evil in a strange and beautiful land to which he has been summoned by Lord Foul the Despairer.

By the end of the third book, he has saved the Land, and fantasy fans the world over have heaved a collective sigh of relief, for the Land is a wonderful place and its inhabitants charming and noble folk.

In **The Wounded Land**, Covenant is back—once again summoned by Foul—but this time with a female companion, Dr. Linden Avery, whom he hardly knows. Several thousand years have passed and the Land has changed: its beauty has been destroyed and its people live in fear of the Sunbane which rules their lives. The power and magic which were used for good in the first books have been perverted and the sun turned into an instrument of torture which requires constant infusions of human blood for sustenance. Donaldson does a masterful job conveying the horror of this new evil: for weeks after reading the book I caught myself cringing at the mere mention of the word "sun."

Donaldson is storyteller, but there is more to his books than just a storyline. His characters are complex and his ideas thought-provoking. An added joy is his writing style, which, in a time when such things are accorded little importance, is captivating. His characters have an enormous vocabulary and use constructions which readers may not find familiar. The Land and its residents, however, are subject to few of the same rules that govern us, so their somewhat formal and slightly archaic speech does not seem the least bit out of place.

Donaldson fans who have read the first trilogy will not be surprised to find the same high quality writing in **The Wounded Land**, nor will they find it easy to wait for the publication of **The One Tree**, the next installment in the second trilogy. To those who have never read one of his books, I commend them all, although it is not necessary to have read **The Chronicles of Thomas Covenant** to enjoy **The Wounded Land**. —EBS



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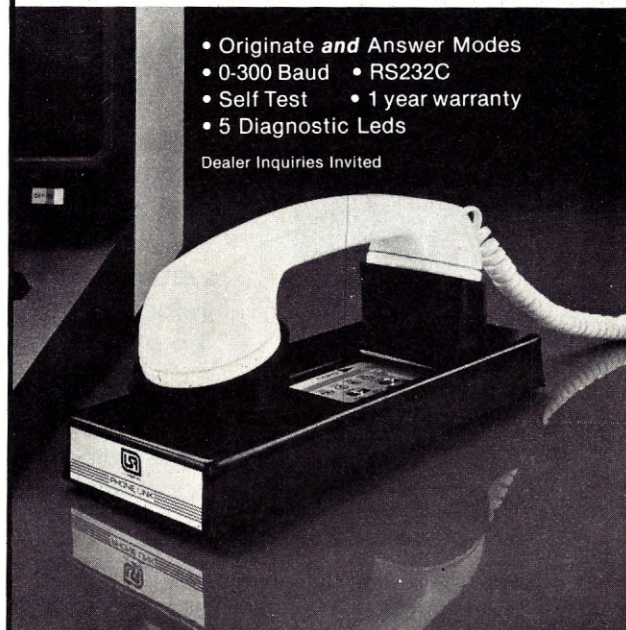
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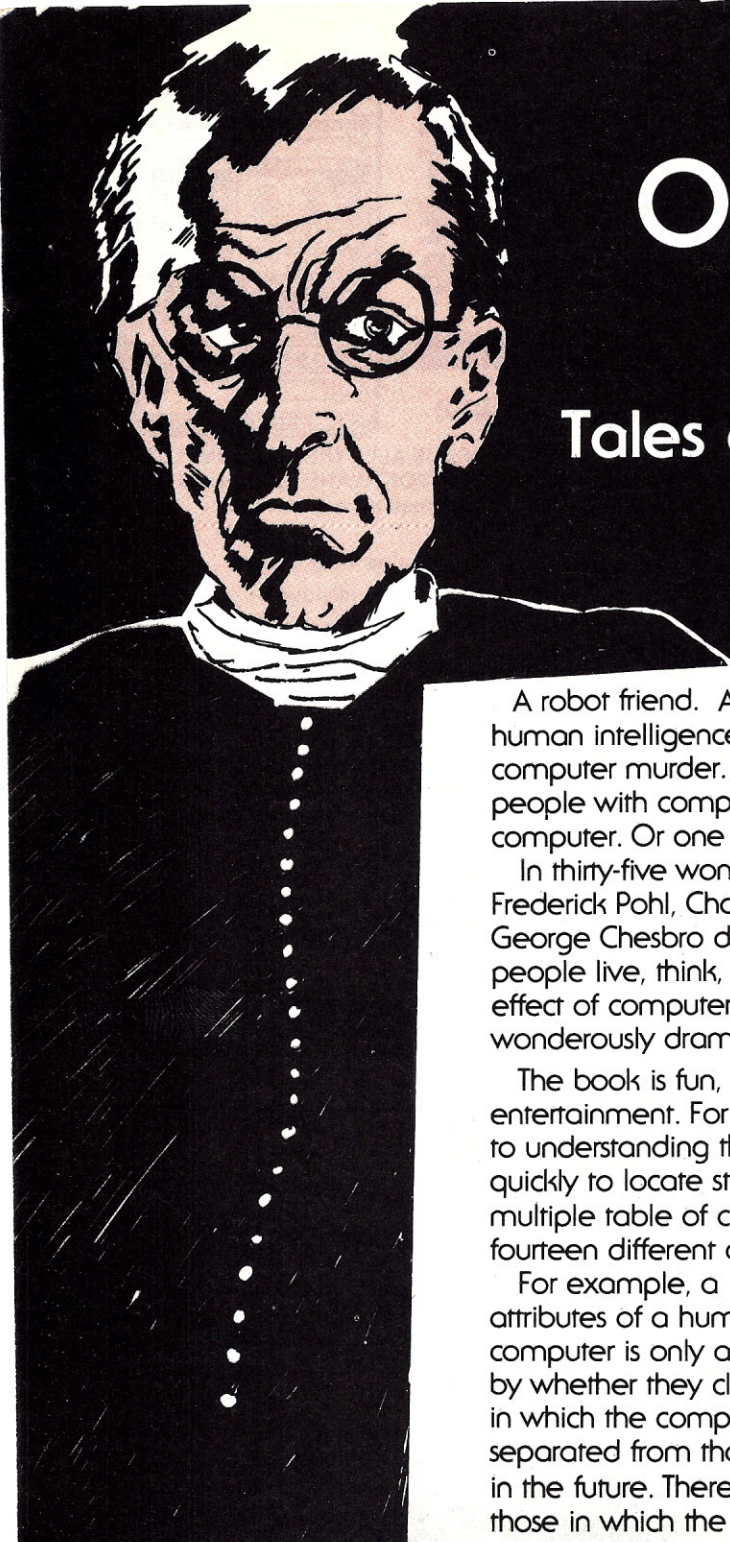


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# creative computing press

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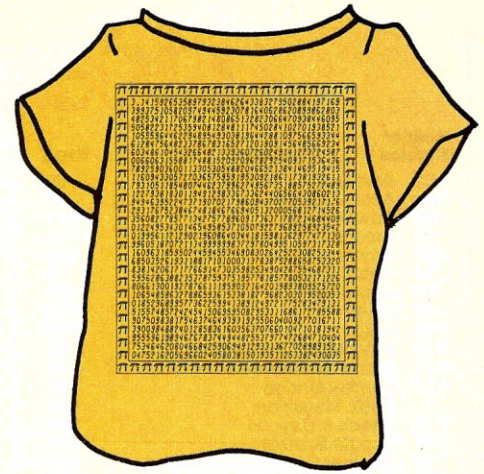




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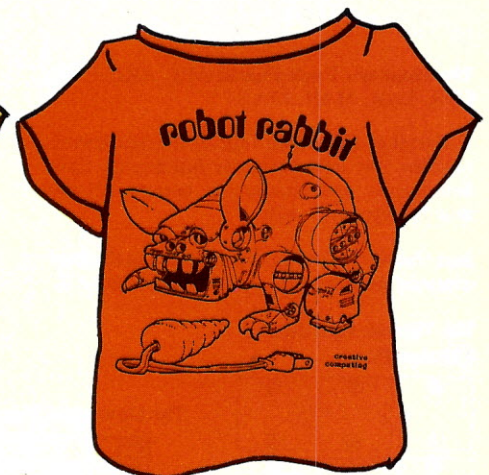
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133	Color Software	123	168	Microsoft Consumer Products	15	182	U.S. Robotics	189
130	Compumax	123	165	Micro Systems Software	137	184	U.S. Robotics	149
134	Compuserve	23	233	Microtrend International	165	185	U.S. Robotics	173
126	Computer Corner of White Plains	154	234	Minnesota Software	173	190	Voicetek	149
124	Computer Information Exchange	106	224	Misosys	146	192	Xtra-soft	149
148	Computer Programs Unlimited	188	157	Mini Micro Mart	153	Creative Computing		
128	Computer Shopper	189	152	Monument Computer Service	146	300	Adventure	73
149	Computer Station	95	179	Mosaic Electronics	141	300	Air Traffic Controller	91
*	Computer Systems Design	115	191	Mountain Computer	1	300	Atari Software	177
198	Computer Systems International	155	225	Muse Software	19	350	Back Issue Sale	143
145	Computers "R" Us	117	226	Muse Software	113	350	Be a Computer Literate	49
125	Computerware	115	227	Mytee Music	157	350	Basic Computer Games	190
132	Computers Wholesale	125	167	NEBS, Inc.	119	350	Best of Creative Computing	11
137	Computronics	134-135	160	New Earth Television Works	57	300	Brain & Strategy Games	125
138	Computronics	37	203	Nilonel Mfg.	123	350	Computer for Kids	153
158	Continental Software	105	214	NRI Schools	77	350	Computer Coin Games	183
162	Cornsoft Group	133	172	Ohio Scientific	Cover 4	350	Computer Music Record	81
211	Corvus Systems	7	174	Omni Communications	119	300	Ecology Simulations	145
161	Cottage Software	127	166	Orion Software	129	300	Investment Analysis	167
171	CPU Shop	83	169	Pacific Exchanges	148	350	Katie and the Computer	59
120	Dakin5 Corp.	45	204	Pacific Exchanges	177	300	Outdoor Games	127
122	Dakin5 Corp.	117	239	Peripherals Plus	79,111	300	Sorcerer Graphic Games	124
206	Data Soft	47	240	Personal Computer Systems	5	350	Sourcebook of Ideas	163
131	Discount Software Group	139	170	Personal Software	2	300	Space & Sports Games	175
195	Disk-O-Tape	154	228	Professional Data Systems	119	300	Super Invasion	129
*	Dresden Associates	101	175	Program Store	87	*	Subscriptions	43
136	Dynacomp	31	230	Programma International	51	350	T-shirts	191
154	Ecosoft	171	243	Quality Data Supply	157	300	Voodoo Castle	181
139	Educational Courseware	157	231	Quality Software	27	350	Warehouse Sale	65
164	Edu-ware	75	173	R-Alpha	121	*Write advertisers directly		
142	Electronic Specialists	151	188	Racet Computers	141			
150	Exatron	Cover 3	*	Rainbow Computing	141			
140	Frederick Computer Products	159	176	Rainbow Marketware	173			
*	Galaxy	159						

## puzzle answers

**The Monkey's Uncle Puzzle:** APE, ARE, ERE, ERR, EAR, MAR, MAN.

**A Barrel of Fun:** Pour four of the half-barrels together. We now have nine full barrels, three half-barrels, and nine empty barrels. All can now be evenly divided.

**Just One Over:** The answer is 61, being the least common multiple of 2, 3, 4, 5, and 6 (60) + 1.

**The "Royal Aquarium"**  
Thirteen Puzzle:

②	⑦	④
④	④	⑥
①	②	⑨
⑤	⑤	③
⑥	⑧	⑤
①	⑦	⑥

**The Davenport Puzzle:**

○				○
	○		○	
		○		○
	○		○	
○				○

**The Right Connections Puzzle:**

1) On first side of river use jumpers as indicated for identification and label one wire #1 (see Fig. 1).

2) Use half of your round trip ticket.

3) On the other side identify groups and bundle them with twine. Label #1 now, it's the only one not shorted to any other wire (see Fig. 2).

4) Using jumpers, short #1, 2, 4 and 7; short #3, 5 and 8; short #6 and 9.

5) Use the other half of your ticket.

6) Back on the first side of the river remove

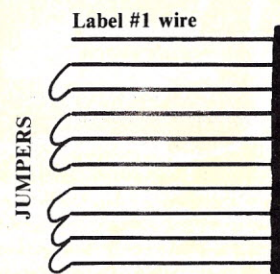


Figure 1.

the jumpers and group them (as they were jumpered) with twine.

7) Now check for the wire which does not show continuity with any other wire. This is labeled #10. #1 is already labeled. Check the twin bundle for continuity with the one labeled #1 and label it #2, and the other as #3. Check the triple bundle for continuity with #1 and label it as #4, check for continuity with #3 and label #5. The other is #6. Go to bundle of four wires and check for continuity with #1 and label it #7. Check for continuity with #3 and label it #8. Check for continuity with #6, and label it #9.

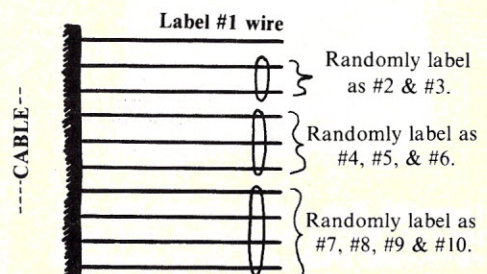


Figure 2.

CREATIVE COMPUTING



# Pump Up Your TRS-80 with the ES/F Mass Storage System



## THESE FACTS SPEAK FOR THEMSELVES!

	CASSETTE	ES/F	MINI-DISK
<b>SPEED</b> (Seconds to load "Blackjack")	56	6 (5' wafer)	6½
<b>CAPACITY</b> (thousands of bytes)	38 (C-20)	64 (75' wafer)	59 (TRSDOS)
<b>RELIABILITY</b> (Designed for digital data?)	NO	YES	YES
<b>SYSTEM COST</b> (First unit plus interface)	\$60	\$250	\$800
<b>MEDIA COST</b> (in quantities of ten)	\$3.10 cassette	\$3.00 wafer	\$3.20 disk

Let's face it. Cassette players were not designed to store digital data and programs. That's why we designed a digital storage system using a continuous tape loop: the Exatron Stringy/Floppy (ES/F) and the Wafer. There's no expensive interface to buy—the ES/F comes ready to pump up your TRS-80.\*

Once your TRS-80\* is pumped up by our ES/F... you won't want to deflate it. We're so sure, that we offer an unconditional 30-day money-back guarantee and a one-year limited warranty. Over 2,000 TRS-80\* owners have met the wafer... why don't you? \*

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\*TRS-80 is a registered trademark of Tandy Corp.

CIRCLE 150 ON READER SERVICE CARD



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Through the miracle of modern technology, a complete computer as powerful as the multimillion dollar room-sized computers of a few years ago can be put in a package the size of a typewriter and sells for as little as a color television set!

Through its years of microcomputer experience, Ohio Scientific has effectively channeled this tremendous computer power into a "friendly" computer with hundreds of personal uses, via a huge software library of programs for a broad range of personal, home, educational and business use.

This available software allows you to use and enjoy your computer without becoming an expert. The Challenger, however, is a powerful, general purpose computer which can be programmed in several languages by those who choose to.

Here are just a few of the popular uses of an Ohio Scientific Challenger Computer:

### Education

The personal computer is the ultimate

educational aid because it can entertain while it educates. Software available ranges from enhancing your children's basic math, reading and spelling ability, through tutoring high school and college subjects, to teaching the fundamentals of computers and computer programming.

### Entertainment

Many of the Challenger's games educate while they entertain, from cartoons for preschoolers to games which sharpen mathematical and logical abilities. But, entertainment doesn't stop here. The Challenger's graphics capabilities and fast operation allow it to display action games with much more detail than the best video games, providing spectacular action in games such as Invaders, Space Wars, Tiger Tank and more! All popular sports such as golf, baseball and bowling are available as simulated computer games as well as many conventional games such as chess where the computer plays the role of a formidable opponent.

### Accounting

Your Challenger computer can keep track of your checkbook, savings account, loans, expenses, monitor your calorie intake and your biorythms.

If you are involved in a business, you can use it to do word processing; accounting, inventory control, order processing, customer lists, client records, mailing labels and planning.

### And more:

This may seem like a lot of uses, but it's only the tip of the iceberg for a general purpose computer. For example, your Challenger can be expanded to control lights and appliances, manage your energy usage and monitor for fire and break-ins. Furthermore, it can communicate with you, with other computers and the new personal computer information services over the telephone.

In fact, the uses of general purpose, personalized computers are expanding daily as more and more people discover the tremendous capabilities

of these new technological wonders.

**Ohio Scientific offers you four personalized computer systems starting at just \$479.**



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